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SOIL SURVEY OF THE GALLATIN FOREST AREA
SOUTHWESTERN MONTANA

INTERIM DRAFT REPORT- APRIL 1984

by Carl E. Davis and Henry F. Shovic

United States Department of Agriculture
Forest Service
in cooperation with the Soil Conservation Service
and the Montana Agricultural Experiment Station

Gallatin National Forest, Box 130, Federal Building, Bozeman, MT 59771

CREDITS

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Section 1. Introduction

GENERAL NATURE OF THE SURVEY AREA

The Soil Survey of the Gallatin Forest Area was begun in 1975 and field work was completed in 1981. This interim report is primarily for Forest use and does not include all the information that will appear in the final report. Maps and the detailed soil description section are not included. Each Ranger District and the Supervisor's Office have clear overlays of the soil map sheets, and soil descriptions are on file at the Soils office.
The entire report is planned for publication as a cooperative NCSS report in 1985.

The Survey Area is located in southwestern Montana (see location map). It lies north of Yellowstone National Park. The Survey Area includes parts of Gallatin, Madison, Meagher, Park, and Sweetgrass counties. The Forest Supervisor's office is located in Bozeman.

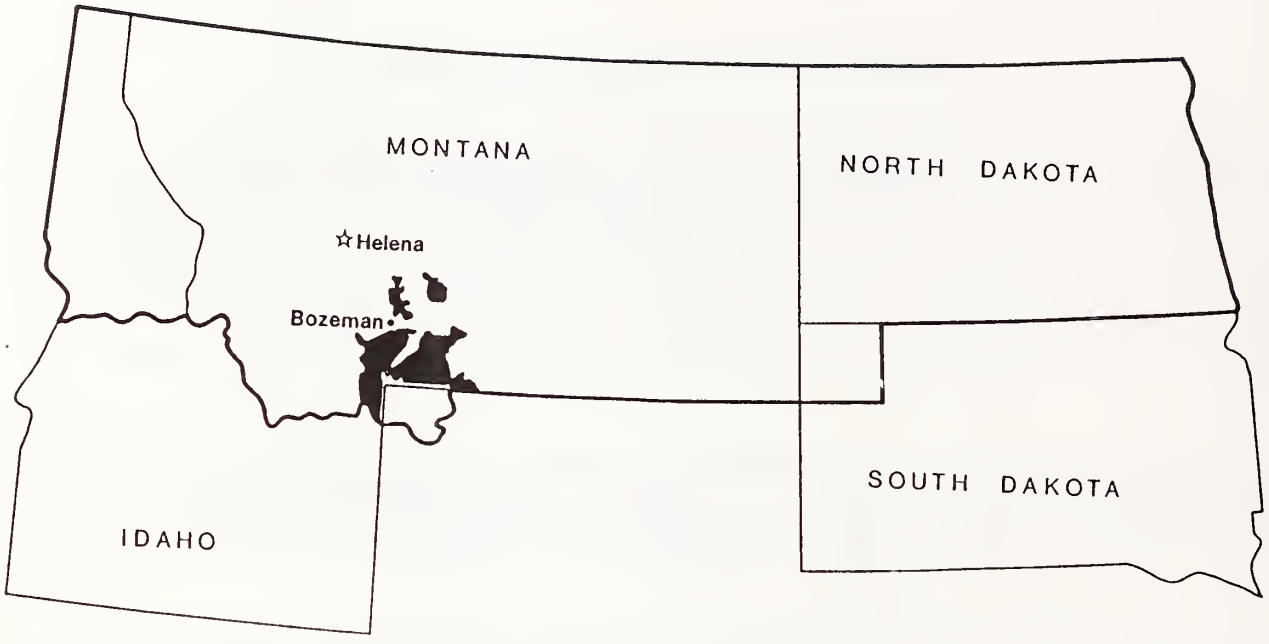
The Survey Area totals about 1,500,000 acres of which about 73 percent is National forest. Most of the private land within the Survey Area is the result of nineteenth century land grants to the railroads. These old grants form a "checkerboard" pattern with National Forest land. The Survey area includes these areas, but does not include areas classified as wilderness or large blocks of private ownership within the Forest boundary.

Land uses in the Survey Area include recreation, livestock grazing, timber production, water production, and wildlife habitat. Mining and oil-gas production are minor uses to date, though there are many unpatented claims and undeveloped oil and gas leases.

The Survey Area includes seven distinct mountain ranges: the Beartooth, Absaroka, Crazy, Bridger, Gallatin, Madison, and Henry's Lake Mountains. Three "blue ribbon" trout streams flow through the Survey Area: the Madison, Gallatin, and Yellowstone. Elevation ranges from about 5,300 feet near Bozeman to 11,316 feet at Hilgard Peak in the Madison Range.

The Area has a continental climate, with precipitation falling mostly as snow. Average annual precipitation ranges from 20 inches in the intermountain valleys to over 80 inches near Cooke City in the Absoroka Mountains. Vegetative communities range from short grass praire, through Douglas fir and lodgepole pine forests, to alpine tundra. Topography varies from steep streambreaks, to rolling hills, glaciated lands, and broad gently rolling "frost churned" plateaus. The mountains of the Survey Area contain a wide range of geologic materials, including igneous intrusions; folded limestones, sandstones, and shales; crystalline basement rocks; and volcanic flows, breccias, and conglomerates.

Soils are relatively young. Most of the area was glaciated during the Pleistocene. Even in non-glaciated areas, weathering has been slow, probably because of the cool climate and rapid stream downcutting.



LOCATION OF THE GALLATIN NATIONAL FOREST, IN SOUTHWESTERN MONTANA.

Soil characteristics are closely associated with parent materials. Soils formed in glacial till are often very cobbly, while those formed in glacial outwash are sandy. Soils formed in materials weathered from limestone can be calcareous and medium textured, or non-calcareous and moderately fine textured depending on the relative age of bedrock exposure and climate. Soils formed in materials weathered from interbedded sandstone and shale can be moderately coarse textured to fine textured, depending on the dominant bedrock and degree of parent material mixing. Soils with no significant subsurface clay accumulation (Cryoborolls and Cryochrepts) are common where parent materials are weathered or eroded from rocks of acid composition (granite, gneiss, etc). Soils with subsurface clay accumulation (Cryoboralfs) are often associated with more basic rocks (basalt, andesite, volcanic agglomerates).

Vegetation has played a dominant role in some areas. Normally, soils formed exclusively under forest vegetation have light colored surface layers and subsurface clay accumulation. Soils under grassland vegetation are darker in color than those under forest, and normally do not have this clay accumulation. However,in some areas the grassland/forest boundary has been fluctuating over time. Here, soils now under grassland or meadow can reflect previous cycles of forest vegetation. This is marked by the presence of clay accumulation in the subsurface layers. Conversely, in these same areas, soils under forest vegetation may have dark surface layers, indicating there has been grassland or meadow vegetation at some time in the past.

HOW TO USE THIS SOIL SURVEY

1. Locate your area of interest on the "Index to Map Sheets" on the next page. These map sheets directly overlay USGS 7.5 minute quads (see "Map Sheet Numbers and USGS Quad Names", page I-6).

2. Note the number of the map sheet, and turn to that sheet. These sheets are not included in this draft report. They are available on each Ranger District and in the Soils section, Supervisor's Office, Gallatin National Forest.

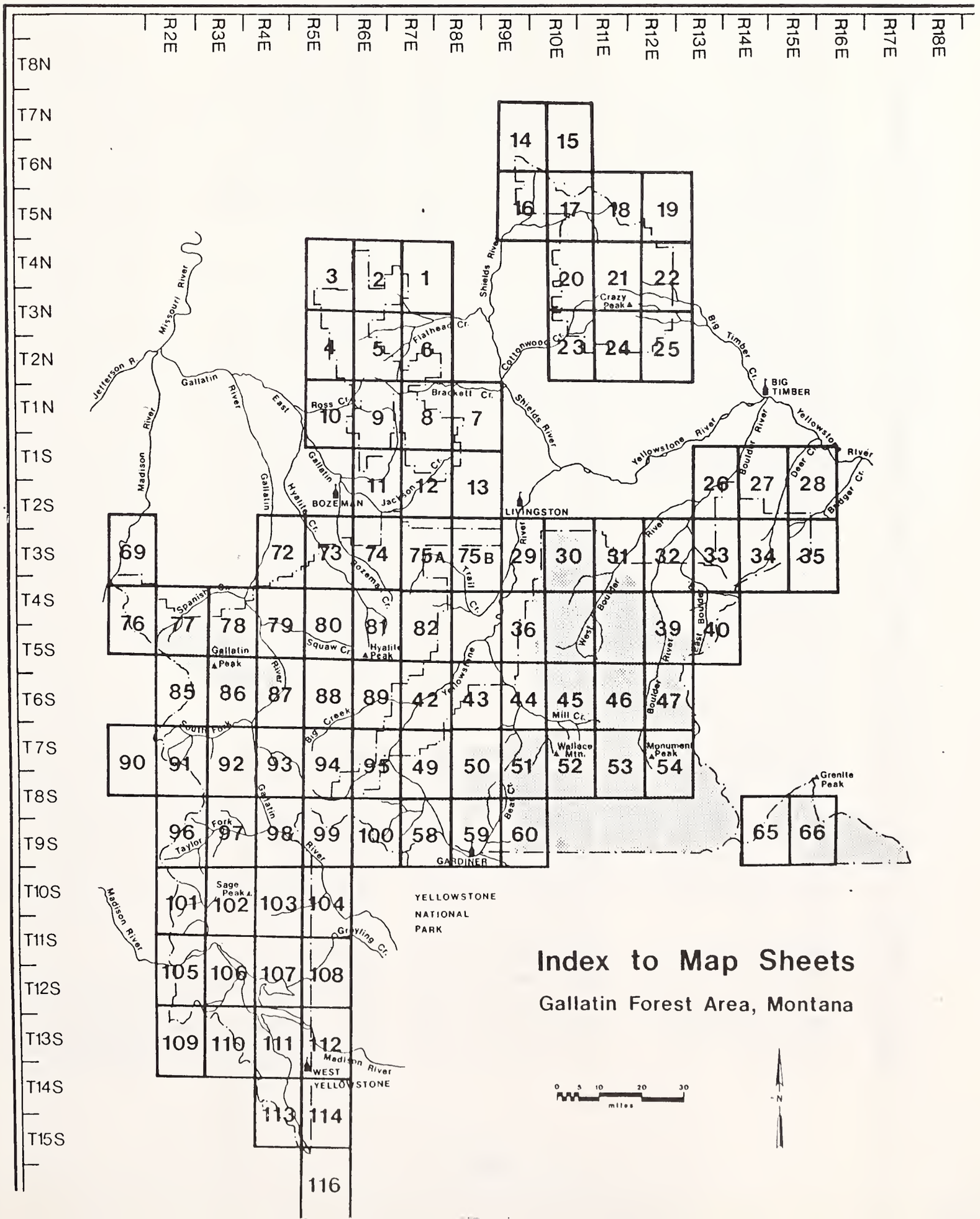
3. Locate your area of interest on the map sheet.

4. List the Map Unit symbols that are in your area.

5. For an overview of Map Unit characteristics, turn to Section 2 "Summary of Map Unit Characteristics".

6. For detailed information on Map Units, turn to "Index to Map Units", page . This lists each Map Unit symbol and the page where that Map Unit is described. Map Unit descriptions are in Section 3.

7. Use and management of the Map Units for engineering, timber, range, wildlife, watershed, and fire are discussed in Section 4 "Use and Management". Tables showing suitability, limitations, and potential of Map Units for various uses are referred to under the discussion of each use.



Index to Map Sheets

Gallatin Forest Area, Montana

Map Numbers and USGS Quad Names

Map Sheet Index No.	Quandrangle Name	Quandrangle Index No.	Map Sheet Index No.	Quandrangle Name	Quandrangle Name
001	Wallrock, MT	610-3-3-4	059	Gardiner SW	510-3-4-3
002	Hatfield Mtn. MT	610-3-3-3	060	Gardiner SE	510-3-4-4
003	Maudlow SE	611-4-4-4	062	Mtn. Wallace SE	510-4-3-4
004	Belgrade NE	511-1-1-1	065	Cooke City SW	509-3-3-3
005	Sedan NW	510-2-2-2	066	Cooke City SE	509-3-3-4
006	Sedan NE	510-2-2-1	069	Norris SE	511-2-4-4
007	Gobbler's Knob, MT	510-2-1-3	072	Bozeman SW	511-1-4-3
008	Sedan SE	510-2-2-4	073	Bozeman SE	511-1-4-4
009	Sedan SW	510-2-2-3	074	Bozeman Pass SW	510-2-3-3
010	Belgrade SE	511-1-1-4	075A	Bozeman Pass SE	510-2-3-4
011	Bozeman Pass NW	510-2-3-2	075B	Chimney Rock, MT	510-2-4-3
012	Bozeman Pass NE	510-2-3-1	076	Ennis NE	511-3-1-1
013	Hoppers, MT	510-2-4-2	077	Spanish Peaks NW	511-4-2-2
014	Rimrock Divide, MT	610-3-1-4	078	Spanish Peaks NE	511-4-3-1
015	Lebo, MT	610-4-2-3	079	Garnet Mtn. NW	511-4-1-2
016	Scab Rock Mtn. MT	610-3-4-1	080	Garnet Mtn. NE	511-4-1-1
017	Virginia Peak, MT	610-4-3-2	081	Fridley Peak NW	510-3-2-2
018	Loco Mtn., MT	610-4-3-1	082	Fridley Peak NE	510-3-2-1
019	Rein Lake, MT	610-4-4-2	085	Spanish Peaks SW	511-4-2-3
020	Campfire Lake, MT	610-4-3-3	086	Spanish Peaks SE	511-4-2-4
021	Crazy Peak, MT	610-4-3-4	087	Garnet Mtn. SW	511-4-1-3
022	Amelong Creek, MT	610-4-4-3	088	Garnet Mtn. SE	511-4-1-4
023	Ibex Mtn. MT	510-1-2-2	089	Fridley Peak SW	510-3-2-3
026	McLeod, MT	510-1-4-1	090	Cameron NE	511-3-4-1
027	Ross Canyon, MT	509-2-3-2	091	Sphinx Mtn. NW	511-4-3-2
028	Packsaddle Butte, MT	509-2-3-1	092	Sphinx Mtn. NE	511-4-3-1
029	Brisbin, MT	510-2-4-4	093	Crown Butte NW	511-4-4-2
030	Livingston Pk. MT	510-1-3-3	094	Crown Butte NE	510-4-4-1
031	Mtn. Rae. MT	510-1-3-4	095	Miner NW	510-3-3-2
032	McLeod Basin, MT	510-1-4-3	096	Sphinx Mtn. SW	511-4-3-3
033	Squaw Peak, MT	510-1-4-4	097	Sphinx Mtn. SE	511-4-3-4
034	Sliderock Mtn. MT	509-2-3-3	098	Crown Butte SW	511-4-4-3
035	Wildcat Draw	509-2-3-4	099	Crown Butte SE	511-4-4-4
036	Emigrant NE	510-3-1-1	100	Miner SW	510-3-3-3
039	Mtn. Douglas NW	510-4-1-2	101	Hebgen Dam NW	411-1-2-2
040	Mtn. Douglas NE	510-4-1-1	102	Hebgen Dam NE	411-1-2-1
042	Fridley Peak SE	510-3-2-4	103	Teepee Creek NW	411-1-1-2
043	Emigrant SW	510-3-1-3	104	Teepee Creek NE	411-1-1-1
044	Emigrant SE	510-3-1-4	105	Hebgen Dam SW	411-1-2-3
045	Mtn. Cowan SW	510-4-2-3	106	Hebgen Dam SE	411-1-2-4
046	Mtn. Cowan SE	510-4-2-4	107	Teepee Creek SW	411-1-1-3
047	Mtn. Douglas SW	510-4-1-3	108	Teepee Creek SE	411-1-1-4
049	Miner NE	510-3-3-1	109	Targhee Peak, ID-MT	411-1-3-2
050	Gardiner NW	510-3-4-2	110	Targhee Pass, ID-MT	411-1-3-1
051	Gardiner NE	510-3-4-1	111	West Yellowstone NW	411-1-4-2
052	Mtn. Wallace NW	510-4-3-2	112	West Yellowstone NE	411-1-4-1
053	Mtn. Wallace NE	510-4-3-1	113	West Yellowstone SW	411-1-4-3
054	Cutoff Mtn. NW	510-4-4-2	114	West Yellowstone SE	411-1-4-4
058	Miner SE	510-3-3-4	116	Buffalo Lake NE	411-4-1-1

HOW THIS SURVEY WAS MADE

Objectives

This survey was made to provide basic land resource information suitable for evaluating alternative land management opportunities and limitations. Landownership in the survey area is predominantly National Forest; hence, map unit characteristics important to National Forest management objectives are emphasized. Major land uses are timber production, livestock, range, wildlife habitat, and recreation. Evaluating the risk of increasing sediment loads in streams due to road construction and suitability of soils for road construction are also important.

Procedures

Maps were developed by initially delineating map units using aerial photo interpretion, geology maps, and vegetation maps. Map unit characteristics were predicted from the features seen on the photographs and maps; and field observations were made to test these predictions. These observations were made along field traverses and transects through representative delineations of the map units tested. Twenty percent of all delineations in the survey are represented by at least one observation in the field. There are 1,598 field descriptions of soil profiles in a survey area of 1.5 million acres which results in a procedure intensity of about 940 acres for each description. Twenty percent of the map units have no confirming field observations. These map units have some obvious limitation to management, such as very steep slopes and rock outcrops. Descriptions for these map units were developed by inference from map units with similar characteristics. Chemical and physical characteristics of soils not obtainable from field observations are derived from laboratory characterization of 98 soil profiles representative of the major soils occurring in the survye area.

Map Unit Design

Map unit design consisted of choosing features visible on aerial photography which reliably identify map unit characteristics needed to interpet the map unit. The map unit design process is not complete until map units are tested for utility, interpreted for use and described in detail. Map unit design is based on soil survey objectives defined at the start of the survey. The important features which make map units useful are described in the detailed map unit description. The map unit description content is controlled by map unit design. Description is the final step in map unit design.

Map unit descriptions in this survey identify topographic, geologic, vegetative, and soil characteristics since each of these features contributes to some or all of the interpretations. The interpretations attributed to each map unit are based either on these characteristics directly or on a reasoning process which is traceable to these characteristics.

Section 2. Summary of Major Map Unit Characteristics

Modified for Forest Use

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-1

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
12-1A	Consociation of Dystric Cryochrepts, loamy skeletal, mixed	5	Rounded Ridgetops	0-20% Variable 7800-8500	Hard Crystalline Rocks	Dense Upper Subalpine Forest	A8LA-PIAL/ VASC (70%) A8LA/VASC (20%)	34	17,452	1.2
12-1C	Consociation of Typic Cryochrepts, loamy skeletal, mixed	5	Rounded Ridgetops	0-20% Variable 6500-7800	Hard Crystalline Rocks	Dense Lower Subalpine Forest	A8LA/VASC (85%)	14	7,558	.5
12-2A	Consociation of Mollic Cryoboralfs, loamy skeletal, mixed	5	Rounded Ridgetops	0-20% Variable 7200-7800	Volcanic Rocks	Dense Lower Subalpine Forest	A8LA/VASC (75%) ~~A8LA-PIAL/VASC (20%)~~	21	8,276	.5
12-2B	Consociation of Mollic Cryoboralfs, loamy skeletal, mixed	5	Rounded Ridgetops	0-20% Variable 7800-8500	Volcanic Rocks	Dense Upper Subalpine Forest Intermixed With Alpine Meadows	A8LA-PIAL/ VASC (70%) A8LA/VASC (20%)	28	6,947	.5
13-1A	Complex of Dystric Cryochrepts, sandy skeletal, mixed and rock outcrop	20	Rounded Ridgetops	0-45% Variable 9000-9800	Hard Crystalline Rocks	Timberline Forest and Alpine ~~Turfs~~ Meadows	FEID/DECA(70%)	35	12,481	.8
13-2A	Association of Argic Cryoborolls, fine loamy mixed and Typic Cryochrepts, loamy skeletal, mixed	5	Rounded Ridgetops	0-45% Variable 9000-9800	Volcanic Rocks	Timberline Forest (Krummholtz) and Alpine ~~Turfs~~ Meadows	FEID/DECA (90%)	18	4,900	.3
22-1A	Complex of Dystric Cryochrepts, sandy skeletal, mixed and rock outcrop	20	Glacial Troughwalls and Cirque Head-walls	45+% Northern 7600-8500	Hard Crystalline Rocks	Lower and Upper Subalpine Forest Mixed With Rock Out-crop and talus	A8LA/VASC (60%) A8LA-PIAL/VASC (20%)	71	23,479	1.6
22-1B	Complex of Udic Ustochrepts, loamy skeletal, mixed, frigid; and rock outcrop	30	Glacial Troughwalls	45+% Southern 5800-7600	Hard Crystalline Rocks	Dense Subalpine and Sparse Douglas-fir Forest Intermixed With Rock Outcrop, ~~and~~ Talus, and grassland	PSME/FEID (30%) FEID/AGSP (20%) A8LA/CARU (20%)	26	13,490	.9
22-1C	Complex of Rock outcrop and Cryochrepts	50-90	Glacial Troughwalls and Cirque Headwalls	45+% Variable 8200+	Hard Crystalline Rocks	Timberline Forest (Krummholtz) Mixed With Rock Outcrop, ~~and~~ Talus, and Meadows	PIAL-A8LA (10-50%) FEID/DECA (0-50%)	81	66,179	4.4
22-2A	Complex of Typic Cryoboralfs, fine loamy, mixed Typic Cryochrepts, loamy skeletal, mixed and rock outcrop	20	Glacial Troughwalls	45+% Variable 7600-8500	Soft Sedimentary Rocks	Dense Lower Subalpine Forest Intermixed With Rock Outcrop and Meadows	A8LA/VASC (50%) FEID/AGCA (15%)	18	5,996	.4

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-2

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
22-3A	Complex of Typic Cryochrepts, loamy skeletal, mixed and rock outcrop	25	Glacial Troughwalls and Cirque Headwalls	45+% N-NW-E 7600-8500	Volcanic Rocks	Dense Lower Subalpine and Douglas-fir Forest Intermixed With Rock Outcrop and Meadows	ABLA/VASC (50%) PSME/SYAL (15%)	54	20,240	1.3
22-3C	Complex of Cryochrepts, ~~mixed~~ and rock outcrop	20 ~~10-30~~	Gently Rolling, Subdued Ridges; With Some Glacial Moraine	0-20% Variable 8200-8600	Hard Crystalline Rocks	Dense Lower Subalpine Forest Intermixed With Some Meadows	ABLA/VASC (65%) ~~85%)~~ ~~ABLA-PIAL/ VASC (5-20%)~~ 15%	9	6,968	.4
25-1A	Complex of Cryochrepts and Rock Outcrop	10-30	Glacial Cirque Basins	0-20% E-NW 8500+	Hard Crystalline Rocks	Timberline Forest (Krumholtz) and Alpine ~~Turfs~~ Meadows	PIAL-ABLA (10-20%) FEID/DECA ~~(45-70%)~~ (55-60%)	65	12,853	.8
25-3A	Complex of Cryoborolls, Cryoboralfs, and Rock Outcrop	25	Glacial Cirque Basins	0-20% Variable 8500+	Volcanic Rocks	Timberline Forest Intermixed With Meadows and Alpine ~~Turfs~~ Meadows	FEID/DECA (30%) PIAL-ABLA (30%)	94	22,526	1.5
34-1A	Consociation of Dystric Cryochrepts, loamy skeletal, mixed	10	Glacial Moraine	0-20% Variable 7600-8500	Glacial Till-Hard Crystalline Rocks	Dense Upper Subalpine Forest	ABLA-PIAL/ VASC (80%)	51	10,584	.7
34-1B	Undifferentiated group of Argic Cryoborolls, loamy skeletal, mixed and Typic Cryooorolls, loamy skeletal, mixed	5	Glacial Moraine	0-20% Southern 6500-7500	Glacial Till-Hard Crystalline Rocks	Transition Zone Between Grassland and Douglas-fir Forest	ARTR/FEID (75%) PSME/FEID (20%)	26	8,427	.6
34-1C	Consociation of Typic Cryochrepts, loamy skeletal, mixed	10	Glacial Moraine	0-20% Northern 6700-7900	Glacial Till-Hard Crystalline Rocks	Dense Lower Subalpine Forest	ABLA/VASC (80%)	72	39,280	2.6
34-1D	Complex of Typic Cryochrepts, loamy skeletal, mixed and Typic Cryoborolls, loamy skeletal, mixed	5	Glacial Moraine	0-20% Variable 6500-7500	Glacial Till-Hard Crystalline Rocks	Dense to Sparse Douglas-fir Forest With Some Mountain Grassland	PSME/SYAL (55%) PSME/FEID (25%)	18	5,616	.4
34-2C	Association of Mollic Cryoboralfs, fine loamy mixed and Argic Cryoborolls, fine loamy, mixed	5	Glacial Moraine	0-20% N-NE 8000-8500	Glacial Till-Mostly Soft Sedimentary Rocks and Limestone	Dense Upper Subalpine Forest Intermixed With Meadows	ABLA-PIAL/ VASC ~~(60%)~~ 50% FEID/AGCA ~~(35%)~~ (30%)	34	8,928	.6
34-2D	Association of Typic Cryoboralfs, fine loamy, mixed and Argic Cryoborolls, loamy skeletal, mixed	5	Glacial Moraine	0-20% Variable 7000-8000	Glacial Till-Soft Sedimentary Rocks	Dense Lower Subalpine Forest Intermixed With Meadows	ABLA/VASC ~~(65%)~~ 55% FEID/AGCA (35%)	41	17,534	1.2

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-3

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
34-3A	Consociation of Mollic Cryoboralfs, loamy skeletal mixed	10	Glacial Moraine	0-20% Variable 7800-8500	Glacial Till-Volcanic Rocks	Dense to Sparse Upper Subalpine Forest	ABLA-PIAL/ VASC (80%)	26	9,514	.6
34-3B	Consociation of Mollic Cryoboralfs, loamy skeletal mixed	10	Glacial Moraine	0-20% Variable 7200-8000	Glacial Till-Volcanic Rocks	Dense Lower Subalpine Forest	ABLA/VASC (70%)	41	18,141	1.2
34-4B	Complex of Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, loamy skeletal, mixed	0	Glacial Moraine	0-20% Variable 7000-7800	Glacial Till-Undifferentiated	Dense Lower Subalpine Forest Intermixed with some Meadows	ABLA/VASC (80%)	14	4,356	.3
34-4C	Complex of Argic Cryoborolls, fine loamy, mixed and Argic Pachic Cryoborolls, fine loamy, mixed	0	Glacial Moraine	0-20% Variable 6800-7800	Glacial Till-Undifferentiated	Mountain Grassland With Some Islands of Douglas-fir and Subalpine Forest	ARTR/FEID (75%) ~~PSME/SYAL (25%)~~	41	10,236	.7
35-1A	Complex of Dystric Cryochrepts, loamy skeletal, mixed and rock outcrop	15	Glacial Moraine	45+% Variable 7800-8500	Glacial Till-Hard Crystalline Rocks	Dense to Sparse Upper Subalpine Forest	ABLA-PIAL/ VASC	60	15,089	1.0
35-1B	Complex of Argic Cryoborolls, loamy skeletal, mixed and Argic Pachic Cryoborolls, loamy skeletal, mixed	5	Glacial Moraine	45+% Variable 6500-7500	Glacial Till-Hard Crystalline Rocks	Transition Zone Between Mountain Grassland and Douglas-fir Forest	ARAR/FEID or ARTR/FEID (90%)	32	7,034	.5
35-1C	Consociation of Typic Cryochrepts, loamy skeletal, mixed	10	Glacial Moraine	45+% Variable 6800-7800	Glacial Till-Hard Crystalline Rocks	Dense Lower Subalpine Forest	ABLA/VASC (70%)	68	21,193	1.4
35-2C	Association of Mollic Cryoboralfs fine loamy, mixed and Agric Cryoborolls, fine loamy, mixed	5	Glacial Moraine	45+% N-NW 6700-8000	Glacial Till-Limestone and Soft Sedimentary Rocks	Dense Lower Subalpine Forest Intermixed With Meadows	ABLA/VASC (~~70%~~ 55) FEID/AGCA (20%)	41	10,568	.7
35-3A	Complex of Mollic Cryoboralfs, loamy skeletal, mixed and rock outcrop	15	Glacial Moraine	45+% Variable 7800-8500	Glacial Till-Volcanic Rocks	Dense Upper Subalpine Forest Intermixed With Meadows	ABLA-PIAL/ VASC (~~70%~~ 60%) FEID/AGCA (15%)	38	9,796	.6
35-3B	Consociation of Mollic Cryoboralfs, loamy skeletal, mixed	10	Glacial Moraine	45+% Variable 7200-8000	Glacial Till-Volcanic Rocks	Dense Lower Subalpine Forest	ABLA/VASC (70%)	44	13,012	.9

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-4

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANOFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PERCENT
35-4C	Complex of Argic Cryoborolls, fine loamy, mixed and Argic Pachic Cryoborolls, fine loamy, mixed	10	Glacial Moraine	45+% Variable 6800-7800	Glacial Till-Undifferentiated	Mountain Grassland With Some Islands of Douglas-fir and Subalpine Forest	ARTR/FEID (70%) PSME/SYAL (20%)	14	3,413	.2
46-1B	Undifferentiated group of Typic Argiborolls, loamy skeletal, mixed and Aridic Argiborolls, loamy skeletal, mixed	0	Glacial Outwash Plains and Valleys	0-10% Variable 5200-6400	Glacial Outwash-Hard Crystalline Rocks	Mountain Shrubland	ARTR/AGSP (75%) FEID/AGSP (15%)	27	9,707	.6
46-2A	Undifferentiated group of Typic Argiborolls, loamy skeletal, mixed and Aridic Argiborolls, loamy skeletal, mixed	0	Glacial Outwash Plains and Valleys	0-10% Variable 6500-7500	Glacial Outwash-Soft Sedimentary Rocks and Volcanic Rocks	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	FEID/AGSP (40%) ARTR/FEID (35%) PSME/SYAL (20%)	46	13,676	.9
46-3A	Consociation of Typic Cryochrepts, sandy skeletal, siliceous	0	Glacial Outwash Plains	0-10% Northern 6600-7000	Glacial Outwash-Rhyolite and Obsidian Sands	Dense Subalpine Forest	PICO/PUTR(80%)	9	30,442	2.0
53-1A	Association of Typic Cryoborolls, loamy skeletal, mixed; and Argic Cryoborolls, loamy skeletal, mixed; and rock outcrop	15	Dissected Mountain Slopes	10-45% Southern 6800-7800	Hard Crystalline Rocks	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	FEID/AGSP (35%) ARTR/FEID (25%) PSME/SYAL (15%)	43	8,123	.5
53-1D	Consociation of Typic Cryochrepts, loamy skeletal, mixed	5	Dissected Mountain Slopes	10-45% Variable 6100-7800	Hard Crystalline Rocks	Dense Lower Subalpine Forest	ABLA/LIBO (65%) ABLA/ALSI (20%)	35	9,225	.6
53-3A	Association of Argic Cryoborolls, loamy skeletal, mixed and Argic Pachic Cryoborolls, loamy skeletal, mixed	10	Dissected Mountain Slopes	10-45% Southern 6500-7400	Volcanic Rocks	Mountain Grasslands	ARTR/FEID (40%) FEID/AGSP (35%)	35	7,787	.5
53-3B	Association of Mollic Cryoboralfs, fine loamy, mixed and Argic Cryoborolls fine loamy, mixed	5	Dissected Mountain Slopes	10-45% N-S 6500-7800	Volcanic Rocks	Dense Lower Subalpine Forest - N Aspect; Sparse to Dense Douglas-fir Forest - S Aspect	ABLA/VASC (45%) PSME/SYAL (35%)	19	4,893	.3
53-3C	Consociation of Mollic Cryoboralfs, fine loamy, mixed	5	Dissected Mountain Slopes	10-45% Variable 6500-7800	Volcanic Rocks	Dense Lower Subalpine Forest	ABLA/LIBO(80%)	29	6,806	.4

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-5

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
54-1A	Complex of Typic Haploborolls, loamy skeletal, mixed; Udic Ustochrepts, loamy skeletal, mixed, frigid; and rock outcrop	20	Dissected Mountain Slopes	45+% Southern 6000-8000	Hard Crystalline Rocks	Transition Zone Between Douglas-fir Forest and Mountain Grassland	FEID/AGSP (35%) ARTR/FEID (35%)	90	23,511	1.6
54-1B	Complex of rock outcrop; Typic Cryochrepts, loamy skeletal, mixed; and Typic Cryoborolls, loamy skeletal, mixed	40	Dissected Mountain Slopes	45+% Southern 6500-8000	Hard Crystalline Rocks	Sparse to Oense Sub-alpine and Douglas-fir Forest Intermixed With Rock Outcrop	PSME/FEID ABLA/VASC (variable)	67	35,686	2.4
54-1C	Complex of Typic Cryochrepts, loamy skeletal, mixed and rock outcrop	15	Dissected Mountain Slopes	45+% N-S 6500-7500	Hard Crystalline Rocks	Dense Douglas-fir Forest - N. Aspect; Sparse Douglas-fir Forest - S. Aspect	PSME/SYAL (45%) PSME/FEID (30%)	63	18,260	1.5
54-1E	Complex of Dystric Cryochrepts, loamy skeletal, mixed and rock outcrop	30	Dissected Mountain Slopes	45+% Variable 6600-8200	Hard Crystalline Rocks	Dense to Sparse Upper Subalpine Forest, some Meadows, and Rock Outcrop	ABLA-PIAL/VASC (65%)	52	24,082	1.6
54-1G	Complex of Typic Cryochrepts, loamy skeletal, mixed and rock outcrop	15	Dissected Mountain Slopes	45+% N-S 5600-8800	Hard Crystalline Rocks	Dense Lower Subalpine Forest - N Aspect; Douglas-fir Forest - S Aspect	ABLA/VASC (60%) ~~PSME/SYAL (15%)~~	101	52,758	3.5
54-2B	Complex of Rock Outcrop; Typic Ustochrepts, loamy skeletal, mixed, frigid; and Typic Calciborolls, loamy skeletal, carbonatic	40	Dissected Mountain Slopes	45+% S-E 6000-7500	Limestone With Some Hard Sand-stone	Sparse to Dense Douglas-fir Forests and Grassland Inter-mixed With Rock Outcrop	PSME/SYAL (25%) FEID/AGSP (25%)	28	9,650	.6
54-2C	Complex of Rock outcrop and Typic Cryochrepts, loamy skeletal, mixed	40	Dissected Mountain Slopes	45+% Variable 7000-8000	Limestone With Some Hard Sand-stone Rocks	Dense to Sparse Lower Subalpine Forest and Rock Outcrop	ABLA/VAGL ABLA/LIBO (variable)	39	15,968	1.1
54-2D	Complex of Typic Argiborolls, fine loamy, mixed; Typic Ustochrepts, loamy skeletal, mixed, frigid; and rock outcrop	15	Dissected Mountain Slopes	45+% Variable 7800-8500	Soft Sedimentary Rocks	Sparse to Dense Douglas-fir Forest and Mountain Grass-lands	FEID/AGSP (45%) PSME/SYAL (30%)	31	4,409	.0
54-2E	Complex of Cryoboralfs, Cryochrepts; and rock outcrop	15	Dissected Mountain Slopes	45+% Variable 7000-8000	Soft Sedimentary Rocks	Dense to Sparse Lower Subalpine Forest	ABLA/VASC (75%)	6	3,036	.2

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-6

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
54-3A	Complex of Typic Argiborolls, loamy skeletal, mixed; Pachic Argiborolls, loamy skeletal, mixed; and rock outcrop	15	Dissected Mountain Slopes	45+% Southern 6500-7500	Volcanic Rocks	Mountain Grasslands With Some Sparse Douglas-fir Forest	FEID/AGSP (40%) ARTR/FEID (35%)	59	6,210	1.1
54-3C	Complex of Typic Argiborolls, loamy skeletal, mixed; Mollic Eutroboralfs, loamy skeletal, mixed; and rock outcrop	15	Dissected Mountain Slopes	45+% Southern 6500-7500	Volcanic Rocks	Douglas-fir Forest and Mountain Grassland	PSME/SYAL (50%) FEID/AGSP (20%)	58	23,124	1.5
54-3D	Consociation of Mollic Cryoboralfs, fine loamy, mixed	10	Dissected Mountain Slopes	45+% Northern 6500-7800	Volcanic Rocks	Dense Lower Subalpine and Douglas-fir Forest With Some Meadows	ABLA/LIBO (55%) PSME/VAGL (20%)	78	28,439	1.9
54-3E	Consociation of Mollic Cryoboralfs, loamy skeletal, mixed	10	Dissected Mountain Slopes	45+% Variable 7800-8500	Volcanic Rocks	Dense Upper Subalpine Forest	ABLA-PIAL/ VASC (65%) ABLA/VASC (25%)	8	2,448	.2
54-3F	Complex of rock outcrop; Argic Cryoborolls, loamy skeletal, mixed; and Mollic Cryoboralfs, loamy skeletal, mixed	40	Dissected Mountain Slopes	45+% Variable 6800-8000	Volcanic Rocks	Sparse to Dense Lower Subalpine Forest with Rock Outcrop	ABLA/CARU (30%) ABLA-PIAL/ VASC (15%)	58	28,667	1.9
54-5A	Association of Typic Argiborolls, loamy skeletal, mixed; Mollic Eutroboralfs, loamy skeletal, mixed; and rock outcrop	20	Dissected Mountain Slopes	45+% N-S 5200-6200	Volcanic-sedimentary rocks (thin interbedded sandstone and shale)	Transition Zone Between Grasslands and Douglas-fir Forest - S Aspect; and Dense Douglas-fir Forest - N Aspect	PSME/FEID (30%) PSME/PHMA (35%)	27	9,942	.7
54-5C	Complex of Mollic Cryoboralfs, loamy skeletal, mixed; Typic Crtyoboralfs, loamy skeletal, mixed; and rock outcrop	25	Dissected Mountain Slopes	45+% N-S 6000-7200	Volcanic-sedimentary rocks (thin interbedded sandstone and shale)	Dense Douglas-fir and Lower Subalpine Forest - N Aspect; Sparse to Dense Douglas-fir Forest - S Aspect	PSME/PHMA (50%) PSME/FEID (15%)	23	23,121	1.5
61-2A	Undifferentiated group of Typic Argiborolls loamy skeletal, mixed and Typic Calciborolls, loamy skeletal, carbonatic	0	Alluvial Fans	10-20% Variable 5400-6000	Alluvium-limestone and sedimentary rocks	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	FEID/AGSP (30%) ARTR/FEID (30%) PSME/FEID (30%)	16	5,370	.4
64-2A	Undifferentiated group of Cryoborolls	0	Glacial Outwash Benches and Terraces; Flood Plains; and Alluvial Fans	0-10% Southern 6500-8000	Glacial Outwash and Alluvium - Undifferentiated	Transition Zone between Mountain Grasslands and Douglas-fir Forest and hardwood riparian	FEID/AGSP (~~30%~~ 25%) ARTR/FEID (30%) PSME/FEID (30%)	92	16,344	1.1

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GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-7

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PER-CENT
64-2C	Undifferentiated group of Cryoboralfs and Cryoborolls	0	Glacial Outwash Benches and Terraces; Flood Plains; and Alluvial Fans	0-10% Variable 6000-7000	Glacial Outwash and Alluvium - Undifferentiated	Dense Lower Subalpine Forest With Some Meadow and Hardwood Riparian	ABLA/VAGL (40%) PICEA/GATR (20%)	85	16,165	1.1
66-1A	Undifferentiated group of Cryaquolls and Cryaquents	0	Flood Plains	0-10% Variable 6600-8600	Alluvium - Undifferentiated	Wet Meadows and Hardwood Riparian	DECA/CAREX (90%)	71	13,138	.9
71-1A	Complex of Cryoboralfs	0	Landflows (Syn. Landslides)	0-20% Variable 7000-8000	Mass Failure Deposits - Weathered Soft Sedimentary Rocks	Dense Lower Subalpine Forest With Some Meadows	ABLA/GATR (45%) ABLA/VAGL (30%) ~~FEID/AGCA (15%)~~	71	31,386	2.1
71-1B	Complex of Argic Cryoborolls and Argic Pachic Cryoborolls	0	Landflows (Syn. Landslides)	0-20% Variable 6800-7800	Mass Failure Deposits - Weathered Soft Sedimentary Rocks	Mountain Grassland With Some Transitional Douglas-fir Forest and Lower Subalpine Forest	FEID/AGSP (30%) ARTR/FEID (30%) ABLA/VAGL (20%)	30	7,278	.5
71-1C	Complex of Cryoboralfs	0	Landflows (Syn. Landslides)	0-20% Variable 7800-8600	Mass Failure Deposits - Weathered Soft Sedimentary Rocks	Dense Upper Subalpine Forest and Meadows	ABLA-PIAL/ VASC (50%) ABLA/VASC (25%) ~~FEID/AGCA (15%)~~	23	14,771	1.0
71-1D	Complex of Typic Cryoboralfs and Typic Cryochrepts	0	Landflows (Syn. Landslides)	1-20% Variable 7000-8000	Mass Failure Deposits - Weathered Soft Sedimentary Rocks	Dense Lower Subalpine Forest Intermixed With some Meadows	ABLA/VASC (65%)	48	12,293	.8
71-1E	Complex of Argic Cryoborolls and Mollic Cryoboralfs	0	Landflows (Syn. Landslides)	0-20% Southern 6700-7500	Mass Failure Deposits - Weathered Soft Sedimentary Rocks	Dense Douglas-fir Forest and Meadows	PSME/SYAL (45%) ABLA/VAGL (30%) ~~FEID/AGSP (15%)~~	30	6,634	.4
71-2A	Complex of Cryoboralfs	0	Landflows (Syn. Landslides)	0-20% Variable 7000-8000	Mass Failure Deposits - Weathered Volcanic Rocks	Dense Lower Subalpine Forest Intermixed with some Meadows	ABLA/LIBO (75%)	36	13,180	.9
71-2B	Complex of ~~Mollic~~ Cryoboralfs ~~and Typic Cryoboralfs~~	0	Landflows (Syn. Landslides)	0-20% Variable 7000-8200	Mass Failure Deposits - Weathered Volcanic Rocks	Dense Lower Subalpine Forest Intermixed With Meadows	ABLA/VASC (75%) ~~FEID/AGCA (15%)~~	46	14,541	1.0
71-2C	Complex of Cryoboralfs and Cryoborolls	0	Landflows (Syn. Landslides)	0-20% Variable 7800-8500	Mass Failure Deposits - Weathered Volcanic Rocks	Dense Upper Subalpine Forest Intermixed With Meadows	ABLA-PIAL/ VASC (55%) ABLA/VASC (30%) ~~FEID/AGCA (15%)~~	16	10,546	.7

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PERCENT
71-2D	Complex of Argic Cryoborolls and Mollic Cryoboralfs	0	Landflows (Syn. Landslides)	0-20% Southern 6800-7800	Mass Failure Deposits - Weathered Volcanic Rocks	Mountain Grassland and Some Dense Douglas-fir Forest	ARTR/FEID or FEID/AGSP (60%) PSME/SYAL (30%)	21	5,415	.4
82-2B	Complex of Mollic Cryoboralfs, fine loamy, mixed and Typic Cryoboralfs, fine loamy, mixed	5	Dipslopes	10-20% N-W 7000-8000	Folded, sedimentary rocks (interbedded sandstone and shale)	Dense Lower Subalpine Forest With Some Meadows	ABLA/VASC (50%) ABLA/LIBO (20%)	25	10,787	.7
82-2C	Complex of Typic Cryoboralfs, fine loamy, mixed and Aquic Cryoboralfs, fine loamy, mixed	5	Dipslopes	10-20% Northern 8000-8800	Folded, sedimentary rocks (interbedded sandstone and shale)	Dense Upper Subalpine Forest and Some Meadows	ABLA-PIAL/ VASC ~~(70%)~~ (60%)	16	10,498	.7
84-1A	Association of Mollic Cryoboralfs, fine loamy, mixed and Argic Cryoborolls, fine, mixed	5	Dip/scarp Slopes: (Cuesta)	10-45% Northern 6500-7200	Folded, sedimentary rocks (interbedded sandstone and shale)	Dense Lower Subalpine Forest Intermixed With Meadows	PSME/PHMA (~~50%~~ 70%) ABLA/~~VASC (30%)~~ VAGL (50%) ~~FEID/AGCA (15%)~~	21	10,289	.7
84-1B	Consociation of Typic Argiborolls, fine loamy, mixed	5	Dip/scarp Slopes: (Cuesta)	10-45% Southern 6000-7000	Folded, sedimentary rocks (interbedded sandstone and shale)	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	FEID/AGSP (50%) ARTR/FEID (30%)	11	7,242	.5
84-2B	Association of Mollic Cryoboralfs, loamy skeletal, mixed and Argic Cryoborolls, loamy skeletal, mixed	5	Dip/scarp Slopes and Other Slopes Where Bedrock and Bedding Are Controlling the Slopes of the Surface	10-20% Variable 6400-7000	Folded and Faulted Volcanic - Sedimentary Rocks (thin interbedded sandstone and shale)	Dense Lower Subalpine Forest Intermixed With Mountain Grassland	ABLA/VAGL (40%) ABLA/CARU (15%) FEID/AGSP (20%)	26	16,772	1.1
85-2A	Complex of Typic Ustochrepts, loamy skeletal, mixed, frigid; and Typic Calciborolls, loamy skeletal, carbonatic; and rock outcrop	25	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% N-S 6800-8200	Folded and Faulted Limestone With Some Soft Sedimentary Rocks	Sparse to Dense Douglas-fir Forest and Grasslands	PSME/FEID (40%) PSME/SYAL (25%)	36	17,813	1.2
85-2B	Complex of Cryoboralfs, Cryochrepts, and rock outcrop	15	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Variable 6000-7500	Folded and Faulted Limestone With Some Soft Sedimentary Rocks	Dense Lower Subalpine and Douglas-fir Forest With Some Meadows	ABLA/VAGL (45%) PSME/SYAL (30%)	23	11,152	.7
85-3A	Complex of Mollic Cryoboralfs, loamy skeletal, mixed; Argic Cryoborolls, loamy skeletal, mixed; and rock outcrop	20	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Variable 6300-7200	Folded and Faulted, Volcanic - Sedimentary Rocks (thin interbedded sandstone and shale)	Transition Zone Between Douglas-fir Forest and Mountain Grassland	PSME/SYAL (40%) FEID/AGSP (15%) ARTR/FEID (15%)	55	39,772	2.6

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-9

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PERCENT
85-3B	Complex of Mollic Cryoboralfs, loamy skeletal, mixed, and Argic Cryoborolls, loamy skeletal, mixed	10	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Northern 6600-7800	Folded and Faulted, Volcanic - Sedimentary Rocks (thin interbedded sandstone and shale)	Dense Lower Subalpine and Douglas-fir Forest Intermixed With Meadows	ABLA/VAGL (60%) PSME/SYAL (20%)	54	24,920	1.6
86-2A	Association of Typic Cryoboralfs, fine loamy, mixed; and Argic Cryoorolls, fine loamy, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-45% Variable 6800-8000	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Dense Lower Subapline Forest Intermixed With Meadows	ABLA/VAGL (45%) FEID/AGCA (30%)	48	13,548	.9
86-2C	Consociation of Argic Cryoborolls, fine loamy, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-45% Variable 7000-8000	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Mountain Grasslands With Some Lower Subalpine Forest	FEID/AGSP (45%) ARTR/FEID (40%)	86	17,258	1.1
86-2D	Complex of Typic Cryoboralfs, fine loamy, mixed; and Mollic Cryoboralfs, loamy skeletal, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-45% Variable 6800-7800	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Dense Lower Subalpine Forest With Some Meadows	ABLA/VASC (60%) ABLA-PIAL/VASC (15%)	55	18,726	1.2
86-2E	Association of Mollic Cryoboralfs, fine loamy, mixed, and Argic Cryoborolls, fine loamy, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-20% Variable 8200-8800	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Upper Subalpine Forest and Meadows With Some Alpine ~~Turfs~~ Meadows	ABLA-PIAL/VASC (35%) FEID/AGCA (45%)	35	11,368	.8
86-3B	Complex of Typic Cryoboralfs, fine loamy, mixed; and Mollic Cryoboralfs, fine loamy, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-20% Northern 6300-7800	Folded and Faulted, Volcanic - Sedimentary Rocks (thin, interbedded sandstone and shale)	Dense Lower Subalpine Forest and Douglas-fir Forest With Some Meadows	ABLA/VASC (60%) PSME/SYAL (~~20%~~ 25%)	51	23,848	1.6
86-3C	Association of Argic Cryoborolls, fine loamy, mixed and Typic Cryoborolls, loamy skeletal, mixed	5	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	10-45% Variable 5500-7000	Folded and Faulted, Volcanic - Sedimentary Rocks (thin, interbedded sandstone and shale)	Mountain Grasslands With Some Douglas-fir Forest	FEID/AGSP (30%) ARTR/FEID (55%)	82	18,451	1.2
87-1A	Complex of Rock outcrop; Cryochrepts; and Cryooorolls	40-60	Hogback Ridges	45+% Variable 7800-8800	Overthrust limestone With Some Soft Sedimentary Rocks	Timberline Forest and Alpine ~~Turf~~ Meadows Intermixed With Rock Outcrop	ABLA-PIAL/VASC (20-~~40%~~ 35%) FEID/DECA (10-20%)	1	1,437	3.4

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

Table C HFS1-10

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PERCENT
87-1B	Complex of Typic Argiborolls, loamy skeletal, mixed; Typic Calciborolls, loamy skeletal, carbonatic; and rock outcrop	15	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Southern 5800-7800	Limestone With Some Soft Sedimentary Rocks	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	FEID/AGSP (50%) ARTR/FEID (25%)	25	5,342	.4
87-1D	Complex of Typic Cryochrepts, loamy skeletal, mixed; Typic Cryoboralfs, loamy skeletal, mixed; and rock outcrop	20	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Variable 6700-7500	Limestone With Some Soft Sedimentary Rocks	Dense Lower Subalpine Forest With Some Meadows	ABLA/VASC (75%)	57	19,501	1.3
87-2A	Association of Argic Cryoborolls, fine loamy, mixed and Mollic Cryoboralfs, fine loamy, mixed	10	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Southern 6500-7500	Folded and Faulted Soft Sedimentary Rocks (sandstone and shale) With Some Limestone	Transition Zone Between Mountain Grasslands and Douglas-fir Forest	PSME/FEID (50%) FEID/AGSP (25%) ~~PSME/SYAL (15%)~~	46	16,319	1.1
87-2B	Complex of Typic Cryoboralfs, fine loamy, mixed; Typic Cryochrepts, loamy skeletal, mixed; and rock outcrop	15	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Northern 6500-7500	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Dense Lower Subalpine and Douglas-fir ~~Forest~~ Forest Intermixed With Some Mountain Grasslands	PSME/SYAL (45%) ABLA/VASC (25%) ~~PSME/FEID (15%)~~	45	11,488	.8
87-2C	Complex of ~~Consociation of~~ Argic Cryoborolls fine loamy, mixed and Argic Cryoborolls, loamy skeletal, mixed	10	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Southern 6500-7500	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Mountain Grasslands With Some Douglas-fir Forest	FEID/AGSP (40%) PSME/SYAL (25%) ARTR/FEID (20%)	57	9,791	.6
87-2D	Complex of Mollic Cryoboralfs, loamy skeletal mixed; and Typic Cryoboralfs, loamy skeletal, mixed	10	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Northern 6500-8000	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Dense Lower Subalpine Forest	ABLA/VAGL or ABLA/ARCO (80%)	46	14,299	.9
87-2E	Complex of Mollic Cryoboralfs, fine loamy, mixed; Argic Cryoborolls, loamy skeletal, mixed; rock outcrop	20	Mountain Slopes (bedrock and bedding features are controlling the shape of the surface)	45+% Variable 8000-8800	Folded and Faulted, Soft Sedimentary Rocks (interbedded sandstone and shale)	Dense Upper Subalpine Forest Intermixed With Meadows ~~and Alpine Turf~~ Alpine	ABLA-PIAL/VASC (40%) FEID/DECA (20%) ~~ABLA/VASC (20%)~~	39	13,184	.9
88-1A	Consociation of Typic Cryochrepts, loamy skeletal, mixed	5	Flow Plateaus	0-20% Northern 7200-7800	Rhyolite, Welded Tuff and Obsidian	Dense Lower Subalpine Forest	ABLA/VASC ~~(95%)~~ 85%	5	17,330	1.1

GALLATIN FOREST AREA, SOIL SURVEY
SUMMARY OF MAJOR MAP UNIT CHARACTERISTICS

MAP UNIT	SOIL FAMILIES, SUBGROUPS, OR GREAT GROUPS	ROCK OUTCROP (%)	LANDFORM	SLOPE (%) ASPECT ELEVATION (FT)	PARENT MATERIAL	NATIVE VEGETATION	REPRESENTATIVE HABITAT TYPES	TOTAL UNITS	ACRES	PERCENT
88-2A	Complex of Typic Cryochrepts, loamy skeletal, mixed; and Typic Cryoboralfs, loamy skeletal, mixed	0	Dissected Mountain Slopes and Benches	0-20% Variable 6800-7500	Rhyolite, Welded Tuff and Obsidian	Dense Lower Subalpine Forest	ABLA/VASC (90%)	9	12,059	.8
91-2B	Complex of Mollic Cryoboralfs, loamy skeletal, mixed; and Argic Cryoborolls, loamy skeletal, mixed	5	Colluvial Slopes and Avalanche Debris	10-45% Variable 7800-8500	Colluvium - Soft Sedimentary Rocks	Dense Lower and Upper Subalpine Forests Intermixed With Meadows	ABLA/VAGL (55%) FEID/DECA (20%)	31	26,217	.4
93-1A	Rubble Land	40-90	Talus Slopes, Rock Glaciers, Rock Slides	20-45% Variable 7000-9800	Colluvium (rock) - Undifferentiated, Mixed	Rock Rubble (Talus) With Some Alpine Turfs	PIAL-ABLA (5-30%) FEID/DECA (5-30%)	217	45,880	3.0
						TOTALS		4,077	1,504,068	100.0

Section 3. Descriptions of Map Units

HOW TO READ THE DESCRIPTIONS

This section describes each map unit in detail. The descriptions together with the soil maps can be used to determine the suitability and potential of delineations for major land uses within the survey area, for planning land use and the development of resources, and in protecting and maintaining the environment. More information for each map unit is given in the "Use and Management" section. Many of the terms used to describe map units are defined in the glossary.

The map unit description format presents information in sections. The content of each section is described below.

Map Unit Summary summarizes the properties used to separate the map unit from others.

Topography describes properties of landforms included in the map unit which affect its suitability for use. Slope steepness, elevation, aspect, occurrence of rock outcrop and properties of the drainage system are always described. Other properties may be described when important.

Vegetation describes the pattern of habitat types within the map unit and the most common vegetation found on the map unit. Dominant habitat types are given. Others which may occur are described as similar or dissimilar to the dominant. Temperature and moisture conditions indicated by the habitat types are rated relative to conditions within the map unit.

The use of vegetation and habitat types in defining, describing, and interpreting the plant growth environments within map units is described in the "General Nature of the Survey Area" section.

Geology describes the bedrock underlying the map unit or the properties of the geologic deposits in which the soils have formed. The dominant bedrock or deposit is given and others which may occur are described as similar or dissimilar to the dominant. Similarity or dissimilarity is rated relative to the objectives of the survey and has no relationship to geologic classification systems. The use of geology in defining, describing, and interpreting map units is described in the "General Nature of the Survey Area" section.

Soils describes the occurrence and distribution of soils in the map unit and the properties that differentiate the major soils. The occurrence and distribution of the major soils are related to landscape or vegetative properties of map units so the user can locate them within the map unit. Included soils are described as similar or dissimilar to the major soils relative to their response to management.

The soils within map units are classified at the family or higher levels of Soil Taxonomy. The user is referred to soil descriptions of the dominant soils in the "Soil Classification" section for detailed descriptions of soil properties. These descriptions are not included in this draft report.

Management Implications describes the suitability and potential for the most common land uses. Ratings are given for timber management, road construction, livestock, grazing and wildlife habitat. The ratings consider any limitations to use and the feasibility of overcoming the limitations.

Interpretations rates the potential for landslides, soil erosion, sediment delivery to streams, timber productivity, forest understory forage productivity, non-forest forage productivity, and forest regeneration. These ratings are the basic interpretations and are provided to help the user understand them. They also can be used by those planning land management practices not rated in management implications. These are taken from the "Use and Management" section.

Climate describes the climatic properties of map units which are important in predicting hydrologic response. Near annual precipitation, seasonal distribution of precipitation, winter snow depth, timing of spring runoff, length of frost free season, potential evapotranspiration, and hydrologic soil groups are given. They can be used in predicting water yield and park flow periods. They are also related to vegetative productivity.

Hydrologic soils groups are given for hydrologic analyses (Soil Conservation Service, Nat. Eng. Hdbk). Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltation rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface,and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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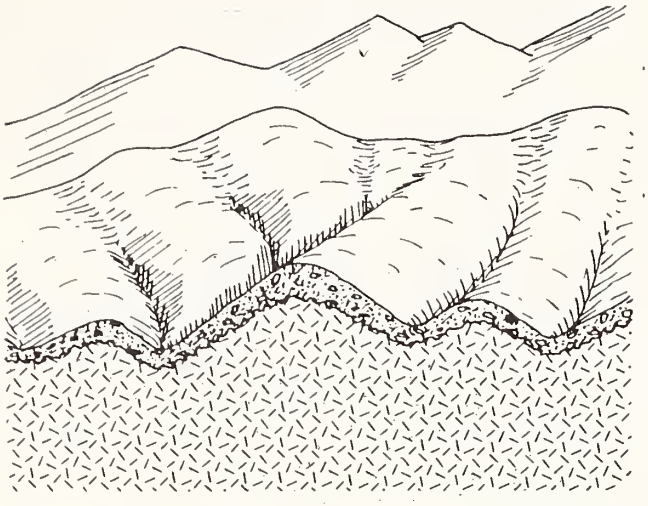


GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 12-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rounded ridges and adjacent gentle sideslopes (center of block diagram). Delineations are mainly in the northern Gallatin Range, western Bridger Range, western Madison Range, the Hebgen Lake area, northern Absaroka-Beartooth Range, and northwestern Crazy Mountains.

M.U. COMPONENTS Soils are moderately coarse textured. They have formed in materials weathered from hard crystalline rock. Native vegetation is upper subalpine forest with scattered meadows.

ADJOINING M.U. Adjacent units are steep irregular rocky slopes or have lower subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,800-8,500	5

The unit consists of smooth rounded nearly level to gently sloping, convex ridgetops and lower slopes. Bedrock outcrops occur on high points or along delineation margins. These rounded ridgetops are dissected by poorly defined intermittent streams. The drainage system has a dendritic pattern with low to moderate channel gradients. Some drainages are filled with hummocky deposits of glacial till. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 70 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC) - 20 percent and Idaho fescue/tufted hairgrass (FEID/DECA) - 5 percent.

HABITAT TYPE DISTRIBUTION The major HT ABLA-PIAL/VASC occurs throughout the unit. Whitebark pine-subalpine fir (PIAL-ABLA) is included as similar at upper elevations. Cold climates and low timber productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. ABLA/VASC occurs at lower elevations and is a more productive timber site. FEID/DECA occurs in mountain meadows on ridgetops.

EXISTING VEGETATION consists of a dense forest of stunted subalpine fir and whitebark pine with some lodgepole pine and Engelmann spruce forest with scattered mountain meadows. Stands are more open along ridgetops and denser on lower sideslopes. The understory is composed of a moderately sparse mat of shrubs, dominated by grouse whortleberry and numerous forbs. On moist sites, sticky geranium, bearded wheat grass, mountain brome and timber oatgrass are common.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; rhyolite and sandstone - 15 percent.

The bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian or Tertiary age. This bedrock generally forms high points in the local landscape. Rhyolite and sandstone are included as similar bedrock. Deposits of glacial till similar to material weathered from the underlying bedrock occur along drainages. Thin deposits of silty loess often mantle the surface.

Included bedrock with dissimilar properties is micaceous schist of Precambrian age. The material weathered from schist is finer textured and less erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained moderately acid with moderately coarse and medium textures. Subsoils contain 35-50 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists primarily of moderately course and medium textured moderately acid soils with light colored surface layers. Included similar soils have dark colored surface layers, fewer subsoil coarse fragments, or less acid subsoils. The soils with fewer subsoil coarse fragments are not obviously associated with landscape features. The soils with dark colored surface layers are near meadows. The soils with less acid subsoils are at lower elevations. Soil surface layers are often formed in silty loess deposits. These soils occupy 80 percent of the unit.

Included are small areas of dissimilar soils. Soils with finer textured subsoils are in areas underlain by micaceous schist and occupy 10 percent of the unit. They are more productive and less erodible. Also included are small areas of somewhat poorly drained soils. These soils are in meadows and occupy less than 5 percent of the unit. These somewhat poorly drained soils have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter less than one inch thick. The surface layer is brown, very gravelly loam about 4 inches thick. The subsoil is pale brown, very cobbly sandy loam about 14 inches thick. The substratum, a very pale brown very cobbly sandy loam, overlies bedrock at depths of 4 to more than 5 feet. See soil description 23 for more detail.

CLASSIFICATION REMARKS The moderately acid soils are Dystric Cryochrepts, loamy skeletal, mixed. The included similar soils are Typic Cryumbrepts, loamy skeletal mixed; Dystric Cryochrepts, coarse loamy, mixed; and Typic Cryochrepts, loamy skeletal, mixed.

The included dissimilar soils with finer textured subsoils are Typic Cryoboralfs, fine loamy mixed. The somewhat poorly drained soils are Argic Cryaquolls, fine, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-32 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited because of harsh subalpine climates. This limitation is difficult to overcome. Individual trees are often poorly formed and may have spiral grain.

ROADS The unit is well suited to road construction. Roads should perform well with standard location, construction, and maintenance practices. Snow cover limits season of use. RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. These forested sites are poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit provides potentially good habitat within late summer and fall range for elk and grizzly bear. It is potentially good blue grouse habitat. The unit provides good security cover when timber stands have reached the sapling-pole stage of development. The unit does not contain or border streams large enough to contain fish habitat.

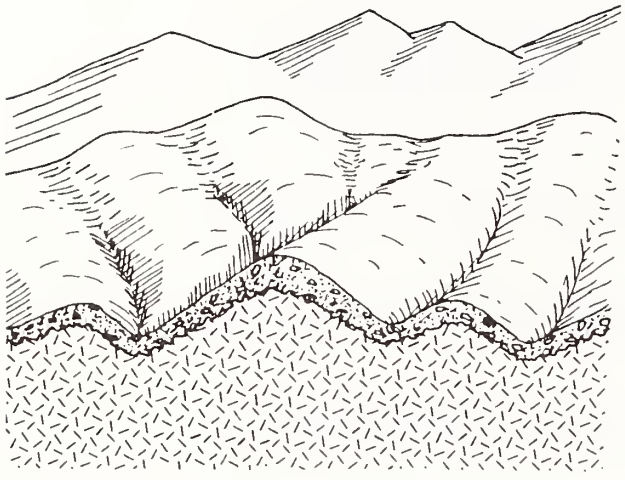
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	very low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow, 20% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	Under 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	A-B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 12-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rounded ridges and adjacent gentle sideslopes (center of block diagram). Delineations are in the northern Gallatin Range, northern Madison Range, west and south of Hebgen Lake, northern Absaroka-Beartooth Range, and southwestern part of the Crazy Mountains.

M.U. COMPONENTS Soils are moderately coarse to medium textured. They have formed in material weathered from hard crystalline rock. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units are steep irregular rocky slopes or support upper subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	6,500-7,800	5

Smooth rounded, nearly level to gently rolling, convex ridgetops and lower slopes are typical landforms. Bedrock exposures occur on high points or along delineation margins. These rounded ridgetops are dissected by poorly defined intermittent streams. The drainage system has a dendritic pattern with low to moderate channel gradients. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/pine grass (ABLA/CARU) - 85 percent. Included HTs with dissimilar management implications are subalpine fir/bluejoint (ABLA/CACA) and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/CARU is only on southern exposures. Subalpine fir/heartleaf arnica (ABLA/ARCO) is included as a similar HT. Cool climates and low timber productivity are associated with these HTs.

Included are up to 10 percent dissimilar HTs. ABLA/CACA occurs on wet sites adjoining stream channels and ABLA-PIAL/VASC is at higher elevations. ABLA/CACA is a more productive timber site and ABLA-PIAL/VASC is less productive.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of a thick mat of shrubs, dominated by grouse whortleberry and blue huckleberry. On southern exposures the understory is dominated by pinegrass.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone and rhyolite - 15 percent.

The bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. This bedrock weathers slowly and outcrops form high points in the local landscape. Sandstone and rhyolite are included as similar bedrock. Deposits of glacial till similar to material weathered from the underlying rock occur in depressions or valleys.

SOILS

GENERAL NATURE OF SOILS The soils are somewhat excessively drained and slightly to moderately acid with moderately coarse and medium textures. The subsoil contains 35-50 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The major soil has light colored surface layers and moderately coarse textured subsoils. It occupies 80 percent of the unit. Included as similar are soils with fewer subsoil rock fragments, darker colored surface layers or moderately acid subsoils. Soils with moderately acid subsoils are at higher elevations. The other similar soils are not associated with landscape features.

Small areas of dissimilar soils are included. Soils with finer textured subsoils are in areas underlain by micaceous schist or along streams and occupy 15 percent of the unit. They are on more productive timber sites and are less erodible.

GENERAL DESCRIPTION The soil surface is covered by a layer of partially decomposed forest litter less than one inch thick. The surface layer is brown gravelly loam about 3 inches thick. The subsoil is very pale brown, very cobbly sandy loam about 29 inches thick. The substratum, a very pale brown extremely cobbly sandy loam, overlies slightly fractured bedrock at a depth of 4 to more than 5 feet. See soil description 23 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. The included similar soils are Typic Cryochrepts, coarse loamy mixed; Typic Cryumbrepts, loamy skeletal, mixed; and Dystric Cryochrepts, loamy skeletal, mixed.

The included dissimilar finer textured soils are Mollic Cryoboralfs, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. Potential annual production is 33-53 cu. ft./acre. There are no limitations to equipment operation. Regeneration is moderately limited because of moisture stress. This stress is caused by the soils low available water holding capacity and competition from pine grass on southern exposures. Design of cutting units to prolong snow melt and creating shade with slash can help overcome this limitation. Rock fragments on the surface or in the soil limit hand planting.

ROADS The unit is well suited to road construction. Roads perform well with ordinary construction and maintenance practices.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. It is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially fair habitat within summer and fall elk range. It provides good security cover after timber stands have reached the sapling-pole stage of development. It does not contain or border streams large enough to support fish.

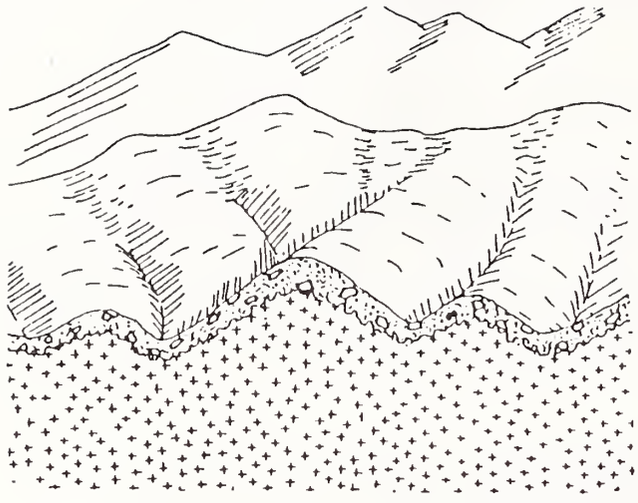
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	very low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Production	low
Non-forest Herbage Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow, 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	A-B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 12-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rounded ridgetops and adjacent gentle sideslopes (center of the block diagram). Delineations are mainly in the Gallatin Range, with some near Lizard lakes in the Madison Range.

M.U. COMPONENTS Soils are medium to moderately fine textured with clay accumulations in the subsoil. They have formed in materials weathered from volcanic rock. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units are steep irregular rocky slopes or support upper subalpine forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
1-20	Variable	7,200 - 7,800	5

The unit consists of smooth rounded, nearly level to gently rolling convex ridgetops and lower slopes. Bedrock outcrops are on high points or along delineation margins. These ridges are dissected by poorly defined intermittent streams. The drainage system has a dendritic pattern with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/elk sedge (ABLA/CAGE) - 75 percent. An included HT with dissimilar management implications is subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC, ABLA/VAGL and ABLA/CAGE occur throughout the unit. Subalpine fir/twinflower (ABLA/LIBO) is included as a similar HT. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. ABLA-PIAL/VASC is at higher elevations, has climatic limitations to regeneration, and is on less productive forest sites.

EXISTING VEGETATION consists of dense lodgpole pine forest. The forest understory is composed of a thick mat of shrubs, dominated by blue huckleberry, and grouse whortleberry with some elk sedge.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock 90 percent and hard crystalline bedrock 10 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. These rocks weather at varying rates. The lava flows are more resistant while the tuffs weather rapidly. Erodible soils and landslide hazards are associated with weathered tuffs.

Included bedrock with dissimilar properties is gneiss of Precambrian age. The material weathered from gneiss is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures. Subsoils contain 35-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with moderately fine textured subsoils and thin dark colored surface layers. Included similar soils have slightly less than 35 percent rock fragments in the subsoil or lighter colored surface layers. The similar soils are not obviously associated with landscape features. These soils occupy 80 percent of the unit.

Small areas of dissimilar soils are included. Soils with medium textured subsoils are near bedrock outcrops or where bedrock is close to the surface. These soils are less productive. They occupy 15 percent of the unit.

GENERAL DESCRIPTION The soil surface is covered by partially decomposed forest litter less than one inch thick. The surface layer is dark brown, gravelly loam about 5 inches thick. The subsoil is very cobbly, reddish brown clay loam about 35 inches thick. The substratum, a brown very stony loam, overlies bedrock at depths of 4 to more than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The included similar soils are Mollic Cryoboralfs, fine loamy, mixed; and Typic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils with medium textured subsoils are Typic Cryochrepts, loamy skeletal, mixed and Dystric Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. Potential annual production is 53 to 71 cu. ft./acre. The unit is well suited to tractor operation. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation may be overcome by using equipment only when soil is dry or covered with snow.

ROADS The unit is well suited to road construction. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good habitat within fall elk range. It provides good security cover after timber stands have reached the sapling-pole stage of development. The unit does not normally contain trout habitat nor does it border streams containing habitat.

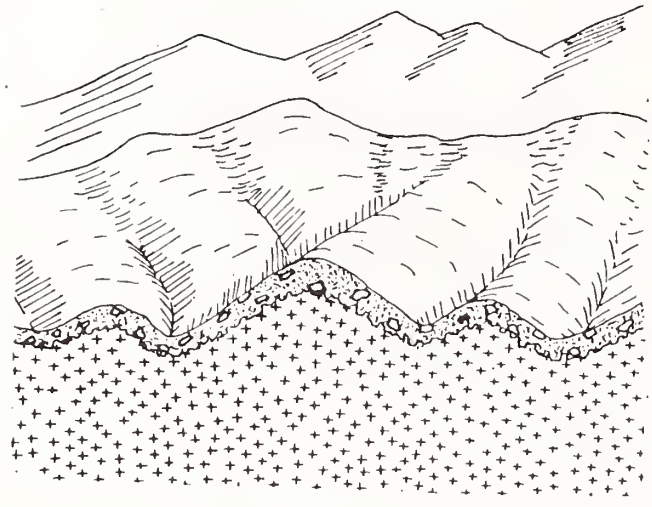
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	very low
Timber Productivity	moderate
Forest Regeneration Limitations	none
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow, 40 rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April - May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 12-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rounded ridges and adjacent gentle sideslopes (center of block diagram). Delineations are mainly in the Gallatin Range, with some near Lizard Lakes in the Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS Soils are medium to moderately fine textured with subsoil clay accumulations. They have formed in material weathered from volcanic rock. Native vegetation consists of upper subalpine forest with a few mountain meadows.

ADJOINING M.U. Adjacent units are steep irregular rocky slopes or support lower subalpine forests.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,800-8,500	5

The unit consists of smooth rounded, nearly level to gently rolling convex ridgetops and lower slopes. Bedrock outcrops are on high points or along delineation margins. These rounded ridges are dissected by poorly defined intermittent streams. The drainage system has a dendritic pattern with low to moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 70 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC) - 20 percent, and Idaho fescue/tufted hairgrass (FEID/DECA) - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC dominates the unit. Subalpine fir - whitebark pine (ABLA-PIAL) is included as a similar HT at higher elevations. Cold climates and low timber productivity are assoicated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. ABLA/VASCis at lower elevations and has higher timber productivity. FEID/DECA occurs in mountain meadows.

EXISTING VEGETATION consists of a dense forest of stunted subalpine fir, whitebark pine, and lodgepole pine and Engelmann spruce forest with scattered mountain meadows. Stands are less dense along ridgetops. The understory is composed of a moderately sparse mat of the shrub grouse whortleberry with numerous forbs.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 90 percent; and hard crystalline bedrock 10 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and some welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. These rocks weather at varying rates. The lava flows are more resistant while the tuffs weather rapidly. Erosion and landslide hazards are associated with weathered tuffs. A thin layer of silty loess mantles the surface.

Included bedrock with dissimilar properties is gniess of Precambrian age. Material weathered from gneiss is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures. Subsoils contain 35-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains soils with thin dark colored surface layers. Included as similar are soils that have less than 35 percent subsoil rock fragments or lighter colored surface layers. The similar soils are not obviously associated with landscape features. These soils occupy 70 percent of the unit. Small areas of dissimilar soils are included. Soils with loam subsoils are near bedrock outcrops and occupy 10 percent of the unit. They have greater bearing strength. Also included are small areas of moderately fine textured soils with thick, dark colored surface layers in mountain meadows. They occupy 15 percent of the unit.

GENERAL DESCRIPTION The surface of the major soils is covered with a layer of partially decomposed forest litter less than one inch thick. The surface layer is dark grayish brown very gravelly loam about 4 inches thick. The subsoil is very cobbly, reddish brown clay loam about 35 inches thick. The substratum, a very cobbly, reddish brown clay loam, overlies bedrock at depths of 4 to more than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The included similar soils are Mollic Cryoboralfs fine loamy, mixed; and Typic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils with loam subsoils are Typic Cryochrepts, loamy skeletal, mixed. The dissimilar soils with thick, dark surface layers are Argic Cryoborolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-32 cu. ft./acre. The unit is well suited to tractor operation. Regeneration is moderately limited because of the harsh climate. This limitation is difficult to overcome. Individual trees are often poorly formed and may have spiral grain.

ROADS The unit is well suited to road construction. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. Mountain meadows occupy about 5 percent of the unit but produces over 90 percent of the available forage. Location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. Forested areas are poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good habitat within summer and fall range for elk and grizzly bears. It provides good security cover when timber stands are sapling or pole size. The unit does not normally contain fish habitat nor does it border streams containing habitat.

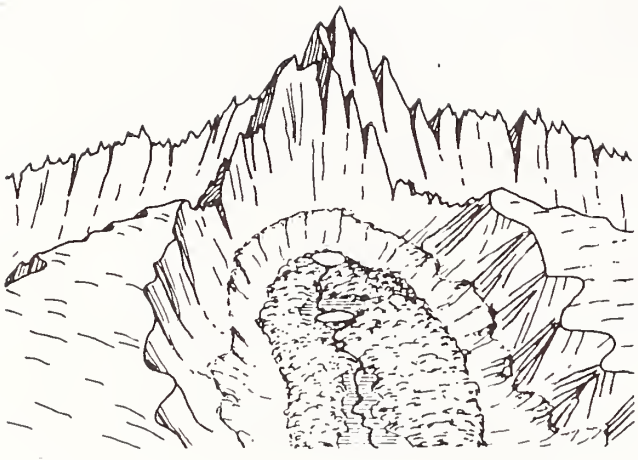
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	30-60
Precipitation Distribution	80% snow, 20% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 13-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of broad, gently rolling to hilly ridgetops and plateaus (lower right and left margins of the block diagram). Delineations are mainly in the western Gallatin Range, western Madison Range, around Hebgen Lake, northern and western Absaroka-Beartooth Range, and Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of moderately coarse textured soils and rubble or rock outcrop. The soils have formed in material weathered from hard crystalline rock. Native vegetation is a short mat of alpine meadow.

ADJOINING M.U. Adjacent units are steep, irregular rocky slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-45	Variable	9,000-9,800	20

The unit consists of broad, nearly level to hilly, smooth, straight to convex ridgetops and plateaus Frost features such as patterned ground are common. Severe winds sweep exposed ridges partially free of snow in the winter. Rock exposures usually occur as rubble areas, with rock outcrops on high points in the unit. These landforms are essentially free of stream dissection. Persistent snowbanks are common on northern exposures. The areas where snowbanks persist normally remain barren after the snow melts. These landforms have high subsurface water storage capacity, but surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho Fescue/Tufted hairgrass (FEID/DECA) - 70 percent. An included HT with dissimilar management implications is tufted hairgrass/sedge (DECA/CAREX) - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/DECA dominates the unit. Whitebark pine-subalpine fir (PIAL-ABLA) is included as a similar HT. Very cold climate and moserate productivity mountain meadows are associated with these HTs in this unit.

Included are up to 10 percent rubble and dissimilar HTs. DECA/CAREX occurs on included wet sites and is more productive.

EXISTING VEGETATION consists of alpine meadows with scattered stands of whitebark pine and subalpine fir at lower elevations. Arctic willow is found in wet meadows. Tufted hairgrass, Idaho fescue, and a variety of sedges dominate alpine meadows. The harsh climate limits the height of meadow plants to less than 6 inches. Vegetative growth forms resemble arctic tundra.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; rhyolite and sandstone - 15 percent.

The bedrock consists of coarse grained bedrock, such as, granite or gniess of Precambrian age. Rhyolite and sandstone are included as similar bedrock. Thin surface deposits of silty loess occur frequently.

Included bedrock with dissimilar properties is micaceous schist of Precambrian age. The material weathered from schist is finer textured and less erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, moderately acid and have coarse textures. Subsoils contain 35-50 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rubble. The soils are moderately acid, and deep, with light colored surface layers. Included are similar soils with slightly darker surface layers, less acid subsoils or that are shallow. The soils that are less acid occur at lower elevations. The shallow soils occur near rubble. The soils with darker surface layers are not obviously associated with landscape features. These soils occupy 65 percent of the unit.

Small areas of dissimilar soils are included. Soils underlain by micacaous shist are finer textured and less erodible. They occupy 10 percent of the unit. Included also are small areas of somewhat poorly drained soils. These soils are near persistent snowbanks or seeps and occupy 5 percent of the unit. They have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed grass roots two inches thick. The surface layer varies from pale brown loam to brown silt loam about 7 inches thick, and frequently is formed in a loess deposit. The upper subsoil is yellowish brown, very cobbly sandy loam, about 9 inches thick. The lower subsoil is light yellowish brown, very cobbly loamy sand about 24 inches thick. The substratum, a light yellowish brown, very cobbly, loamy sand, overlies bedrock at depths of 2 to 4 feet. See soil description 24 for more detail.

CLASSIFICATION REMARKS The major soils are Oystric Cryochrepts, sandy skeletal, mixed. The included similar soils are Typic Cryumbrepts, loamy skeletal, mixed; Typic Cryochrepts, loamy skeletal, mixed; and Lithic Cryochrepts, loamy skeletal, mixed.

The included finer textured dissimilar soils are Typic Cryochrepts, fine loamy, mixed. The included dissimilar somewhat poorly drained soils are Typic Cryaquolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is moderately suited to road construction. Hard non-rippable bedrock limits excavation locally. Snow cover limits season of use. Climate limits establishment of erosion control seedings. Special revegetation practices and erosion control structures help control erosion of cut and fill slopes.

There are many vertical wedges of angular cobbles in the soil. Water moves through them rapidly on steeper slopes during snowmelt. When road cuts intersect them, drainage should be provided.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 1,230 pounds per acre of air dry herbage in normal years. Snow cover limits the grazing season. Loose herding of sheep is particularly important for proper forage utilization in these alpine meadows.

WILDLIFE-FISHERIES This unit is potentially good habitat within summer and fall bighorn sheep and mountain goat range. It also provides some winter range on windswept ridges. Occasional heavy use by adult mule deer has been observed. The unit does not normally contain trout habitat nor does it border streams containing habitat.

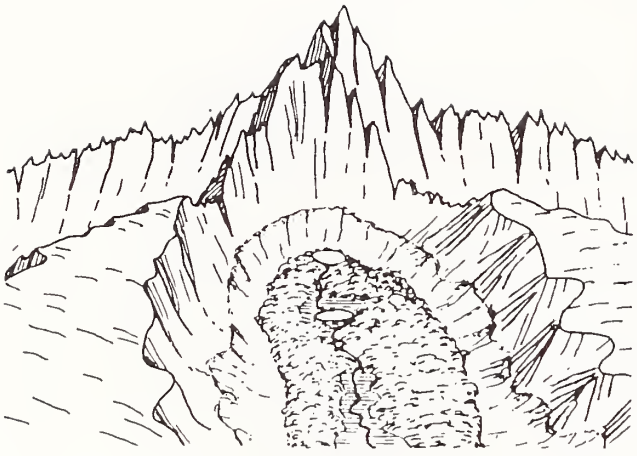
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	high
Sediment Delivery Efficiency	very low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	June
Length of Frost Free Season (days)	Under 50
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	A, B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 13-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of broad, gently sloping to hilly ridgetops and plateaus (lower right and left margins of the block diagram). Delineations occur mainly along the divide in the Gallatin Range and in the Independence area of the Absaroka-Beartooth Range.

M.U. COMPONENTS Soils are moderately fine textured. They have formed in materials weathered from volcanic rock. Native vegetation is a short mat of alpine meadow.

ADJOINING M.U. Adjacent units are typically steep, irregular rocky slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-45	Variable	9,000-9,800	5

The unit consists of broad, gently sloping to hilly ridgetops and plateaus. Frost features such as patterned ground are common. Severe winds sweep exposed ridges partially free of snow in the winter. Rock exposures usually occur as rubble areas and rock outcrops on high points in the unit. These landforms are essentially free of stream dissection. Persistent snowbanks are common on northern exposures. The areas where snowbanks persist normally remain barren after snowmelt. The landforms have high subsurface water storage capacity, but surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho Fescue/tufted hairgrass (FEID/DECA) - 90 percent. An included HT with dissimilar management implications is tufted hairgrass/sedge spp. (DECA/CAREX) - 5 percent.

HABITAT TYPE DISTRIBUTION FEID/DECA dominates the unit. Included as a similar HT is ABLA-PIAL. Very cold, dry climates and moderate forage productivity are associated with these HTs in this unit.

The included dissimilar HT DECA/CAREX occurs on poorly drained soils and is a more productive range site.

EXISTING VEGETATION consists of alpine meadow with scattered stands of whitebark pine and subalpine fir at lower elevations. Arctic willow is in wet meadows. The alpine meadows are dominated by tufted hairgrass, Idaho fescue and a variety of sedges. The harsh climate limits the height of meadow plants to less than 6 inches. Vegetative growth forms resemble arctic tundra.

GEOLOGY

OCCURRENCE The unit is underlain volcanic bedrock - 90 percent; and hard crystalline bedrock - 10 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. These rocks weather at varying rates. The lava flows are more resistant while the tuffs weather rapidly. Erodible soils and landslide hazards are associated with weathered tuffs. There is often a thin surface deposit of silty loess.

Included bedrock with dissimilar properties is gneiss of Precambrian age. Material weathered from gneiss is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. Subsoils contain 15-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of an association of soils. Soil properties vary with topographic position. Soils on gently rolling ridges have light colored surface layers and lack subsoil accumulations of clay. They occupy 50 percent of the unit. Soils on gently sloping plateaus have dark colored surface layers with subsoil clay accumulation. They occupy 35 percent of the unit. Included in both areas as similar are soils with little clay accumulation. Soil surface layers are often formed in silty loess deposits.

Small areas of dissimilar soils are included. Somewhat poorly to poorly drained soils occur in swales or around seeps and occupy 10 percent of the unit. These soils are more productive and have lower bearing strength.

GENERAL DESCRIPTION The soils with light colored surface layers have pinkish gray, gravelly silt loam surface layers about 7 inches thick. Subsoils are brown to dark brown, very cobbly loam about 13 inches thick. The substratum, a reddish brown, very cobbly loam, overlies bedrock at depths of 3 to more than 5 feet. See soil description 21 for more detail.

The soils with dark colored surface layers have dark brown, silt loam surface layers about 8 inches thick. Subsoils are dark brown, clay loam about 15 inches thick. The substratum, a reddish brown, gravelly clay loam, overlies bedrock at a depth of 4 to more than 5 feet. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Typic Cryochrepts, fine loamy, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included as similar are Typic Cryoborolls, fine loamy, mixed.

The included dissimilar somewhat poorly to poorly drained soils are Argic Pachic Cryoborolls, fine loamy, mixed; and Argic Cryaquolls, fine mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited for timber management.

ROADS The unit is well suited to road construction. Snow cover limits season of use. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations. The harsh climate limits establishment of erosion control seedings. Special revegetation practices and erosion control structures can help control cut and fill erosion. There are many vertical wedges of angular cobbles in the soil. Water moves rapidly through them on steeper slopes during snowmelt. When road cuts intersect them, drainage should be provided.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 1,365 pounds per acre of air dry herbage in normal years. Snow cover limits the grazing season. Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand trampling. Loose herding of sheep is particularly important for proper forage utilization in these alpine meadows.

WILDLIFE-FISHERIES This unit is potentially good habitat within bighorn sheep and mountain goat summer and fall range. It also provides some winter range on windswept ridges. Occasional heavy summer use by elk in the Windy Pass area has been observed. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	June
Length of Frost Free Season (days)	Under 50
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, rocky slopes (center of block diagram). Delineations are mainly in the central Gallatin Range, western Bridger Range, northern Madison Range, north and west of Hebgen Lake, and northern and western Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of coarse textured soils and rock outcrop. The soils have formed in materials weathered from hard crystalline rock. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units are valley bottoms or rocky slopes with timberline vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,600-8,500	20

The unit consists of steep, rocky slopes forming the irregular concave sidewalls of U-shaped valleys and headwalls around cirque basins. Snow avalanches, slope unraveling and rock slides occasionally occur on these steep slopes. Bedrock outcrops form occasional cliffs and numerous ledges. Bouldery rubble occurs at the base of slopes and below bedrock outcrops. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel pattern with steep channel gradients. Upper slopes have little subsurface water storage capacity and surface runoff occurs during snowmelt. Lower slopes have high subsurface water storage capacity and surface runoff leaves the unit rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (BLA/VAGL), and subalpine fir/pine grass (ABLA/CARU) - 60 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI), subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) and Douglas-fir/snowberry (PSME/SYAL) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/CARU occurs only on southern exposures. Subalpine fir/heartleaf arnica (ABLA/ARCO) is included as a similar HT. Cool, moist climates and low forest productivity are associated with these HTs in this unit. Included are up to 20 percent dissimilar HTs. ABLA/ALSI occurs on northern exposures and is more productive. ABLA-PIAL/VASC occurs at higher elevations and is less productive. PSME/SYAL occurs on southern exposures at lower elevations where regeneration is limited by moisture stress.

EXISTING VEGETATION consists of dense lodgepole pine forest. Numerous rock outcrops and rubble areas are scattered throughout. The forest understory is a dense mat of grouse whortleberry, blue huckleberry and pinegrass.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; and sandstone - 15 percent.

The bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. This bedrock weathers slowly and is exposed on high points in the local landscape. Sandstone and intrusive stocks are included as similar bedrock.

Included bedrock with dissimilar properties is micaceous schist of Precambrian age. Material weathered from schist is finer textured and more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are excessively drained, and coarse textured. Subsoils contain more than 35 percent angular and subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock. Rock outcrop and talus occupy 20 percent of the unit. Rock outcrop occurs randomly throughout the unit while rubble is on lower slopes. The unit contains deep, moderately acid soils. Included as similar are less acid or shallower soils. Less acid soils are at lower elevations in finer textured colluvial deposits. The shallow soils are adjacent to rock outcrops. These soils occupy 70 percent of the unit.

Included are small areas of dissimilar soils. Moderately fine textured soils occur in areas underlain by micaceous schist and occupy 10 percent of the unit. They are more erodible.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter 1/2 to 2 inches thick. The surface layer is pale brown, very cobbly sandy loam about 6 inches thick. The subsoil is light yellowish brown, very cobbly sandy loam, about 10 inches thick. The substratum, a light yellowish brown, very cobbly loamy sand, overlies bedrock at depths of 2 to more than 5 feet. See soil description 24 for more detail.

CLASSIFICATION REMARKS The major soils are Dystric Cryochrepts, sandy skeletal, mixed. Included similar soils are Typic Cryochrepts, sandy skeletal, mixed; and Lithic Cryochrepts, sandy skeletal, mixed.

The included dissimilar moderately fine textured soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 15-53 cu. ft./acre. Slope steepness and rock outcrop limit equipment use. Cable yarding systems help overcome this limitation. Rock outcrop also limits felling and slash disposal operations. Rock fragments on the surface and in the soil make planting difficult.

ROADS The unit is poorly suited to road construction. Hard, non-rippable bedrock severely limits excavation and slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on steep cutbanks and is rough when used as native road surface. Revegetation of cut and fill slopes is limited by droughty, extremely stony material. Special practices can be required to reestablish vegetation.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. Without planting, these forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially fair fall habitat within mountain goat and bighorn sheep fall range. It provides some security cover for elk and mule deer on lower slopes. The unit does not normally contain trout habitat but borders streams that do.

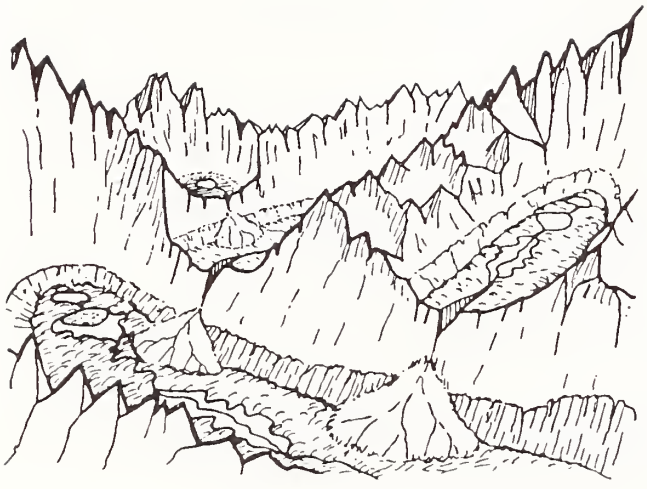
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	high
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	Low
Hydrologic Soil Groups	B, C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, rocky slopes (center of block diagram). Delineations are mainly in the northern Madison Range, north and west of Hebgen Lake, northern and western Absaroka-Beartooth Range, and eastern Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of moderately coarse textured soils and rock outcrop. The soils have formed in material weathered from hard crystalline rock. Native vegetation is mountain grassland and Douglas-fir forest.

ADJOINING M.U. Adjacent units are valley bottoms or steep rocky slopes with subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	5,800-7,600	30

The unit consists of steep, rocky slopes forming the irregular concave sidewalls of U-shaped valleys and headwalls around cirque basins. Snow avalanches and slope unraveling occur on these steep slopes occasionally. Bedrock outcrops form occasional cliffs and numerous ledges. Bouldery talus occurs at the base of slopes and below bedrock outcrops. These ridges are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have low subsurface water storage capacity on upper slopes, and surface runoff occurs during snowmelt and intense storms. Delivery of runoff water to streams is rapid.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of a complex of Douglas-fir/ Idaho fescue (PSME/FEID) - 30 percent and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 20 percent. Included HTs with dissimilar management implications are Douglas-fir/snowberry (PSME/SYAL) and subalpine fir/pinegrass (ABLA/CARU) - 20 percent.

HABITAT TYPE DISTRIBUTION PSME/FEID occurs in open Douglas-fir forest. Limber pine and other Douglas-fir HTs with bunchgrass understory unions are included as similar. Warm, dry climates and low timber productivity are associated with these HTs in this unit. FEID/AGSP occurs in mountain grasslands. Low range site productivity is associated with this HT in this unit.

Included are up to 20 percent dissimilar HTs. PSME/SYAL occurs at lower and ABLA/CARU at upper elevations. These HTs are more productive timber sites.

EXISTING VEGETATION consists of a complex pattern of open growing Douglas-fir forest and mountain grassland. The forest understory is dominated by bunchgrasses. The mountain grasslands contain bluebunch wheatgrass, Idaho fescue, western needlegrass and junegrass. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 75 percent; and sandstone - 25 percent.

The bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. This type of bedrock is exposed on high points in the local landscape. Sandstone and intrusive stocks are included as similar bedrocks.

Included bedrock with dissimilar properties is micaceous shist of Precambrian age. Schist weathers to finer textured material which is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, and moderately coarse textured. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of soils and rock. Rock outcrop and talus occupy 30 percent of the unit and form prominent cliffs and ledges.

Soil properties vary with vegetation. Soils formed under sparse forest have light colored surface layers. Included are similar soils with slightly more clay in the subsoil. These soils occupy 40 percent of the unit. Soils develloped in mountain grassland have dark colored surface layers. They occupy 20 percent of the unit.

Small areas of dissimilar soils are included. Shallow soils near rock outcrops occupy 10 percent of the unit. They are less productive timber sites.

GENERAL DESCRIPTION The soils with light colored surface layers have grayish brown, gravelly sandy loam surface layers about 6 inches thick. Subsoils are pale brown, very cobbly sandy loam, about 15 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 26 for more detail.

The soils with dark colored surface layers have dark grayish brown, very gravelly loam surface layers about 7 inches thick. The subsoil is light yellowish brown, very gravelly sandy loam about 17 inches thick. The substratum, a yellowish brown, very gravelly, sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description [illegible] for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Udic Ustochrepts, loamy skeletal, mixed, frigid and the soils with dark colored surface layers are Typic Haploborolls, loamy skeletal mixed. Included similar soils are Typic Eutroboralfs, loamy skeletal, mixed.

The included dissimilar shallow soils are Lithic Ustochrepts, loamy skeletal, mixed, frigid.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-26 cu. ft./acre. Slope steepness and rock outcrop limit equipment use. Cable logging systems can overcome this limitation. Rock outcrop limits felling and slash disposal operations. Moisture stress severely limits regeneration. Natural regeneration may be limited to years when seed production is good and precipitation is above average. Use of shelterwood and group selection of harvesting systems improve regeneration success. Rock fragments on the surface or in the soil make planting difficult.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severly limits excavation. Slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on cutbanks and is difficult to revegetate. Special revegetation practices may be needed to establish erosion control seedings.

RANGE The unit is moderately suited to range management. Slope steepness and lack of stockwater severely limit access to forage. Livestock tend to concentrate on small included less sloping areas. Drift fences, hearding, and salting away from water help overcome these limitations. The forest understory produces moderate amounts of forage and productivity increases following timber harvest. The potential plant communities in mountain grasslands produce about 892 pounds per acre of air dry herbage in normal years. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good winter habitat for mountain goat and bighorn sheep and year long mule deer habitat. It is potentially good blue grouse habitat. Streams within the unit do not normally contain fish habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	high
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	low

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	[illegible] 35
Precipitation Distribution	[illegible]0% snow; 60% rain
Average Winter Snow Depth (inches)	[illegible] 25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	High
Hydrologic Soil Groups	A, B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, very rocky mountain peaks (upper center of block diagram). Delineations occur mainly at high elevations in every mountain range in the survey area.

M.U. COMPONENTS The unit contains a complex of rock outcrop and coarse to medium textured soils. The soils have formed in material weathered from hard crystalline or volcanic rock. Native vegetation is timberline forest and alpine meadow.

ADJOINING M.U. Adjacent units are gently sloping cirque basins, moderately steep valley bottoms or steep rocky slopes with subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	8,200+	50-90

The unit consists of steep, very rocky mountain peaks forming the irregular concave sidewalls of U-shaped valleys and headwalls around cirque basins. Avalanche paths and rock slides are common. Bedrock outcrops form numerous cliffs and ledges. Bouldery rubble occurs at the base of slopes and below bedrock outcrops. These peaks are dissected by poorly defined intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms are stable except on the steepest slopes where soil and rock tend to unravel. They have little subsurface water storage capacity and delivery of runoff to streams is rapid.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of a complex of barren rock outcrop 50-90 percent; whitebark pine-subalpine fir (PIAL-ABLA) and Idaho fescue/tufted hairgrass (FEID/DECA) 0-40 percent. An included HT with dissimilar management implications is subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) 10 percent.

HABITAT TYPE DISTRIBUTION PIAL-ABLA and FEID/DECA dominate the unit. A very cold climate and very low timber and range site productivity are associated with these HTs in this map unit.

The included dissimilar HT ABLA-PIAL/VASC occurs at lower elevations and is a more productive timber site.

EXISTING VEGETATION The highest mountain peaks are barren except for lichens or mosses on rocks. Isolated stands of stunted, whitebark pine and subalpine fir or alpine meadow occur in vegetated areas.

GEOLOGY

OCCURRENCE The unit may be underlain by hard crystalline bedrock or volcanic bedrock - 100 percent.

The hard crystalline bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. The volcanic bedrock is a repetitive sequence of lava flows and mudflow breccias of Tertiary age. Delineations are underlain entirely by one or the other of these bedrocks. Thinly interbedded sandstone and shale (Livingston group) are included similar bedrocks.

Included bedrocks with dissimilar properties are micaceous schists of Precambrian age or welded tuffs of Tertiary age. Material weathered from these bedrocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well to excessively drained with coarse to medium textures. Subsoils contain more than 35 percent angular and rounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of rock outcrop and soils. Rock outcrop and rubble occupy 50-90 percent of the unit.

Texture of the soil material varies with parent material. Medium textured soils are associated with volcanic rocks while coarse and moderately coarse textured soils are associated with hard crystalline rocks. Soils underlain by hard crystalline bedrock are more acid than soils underlain by volcanics. Included as similar are shallow soils and soils with a mean annual temperature below 32 degrees F.

GENERAL DESCRIPTION The surface layer is pale brown, very cobbly sandy loam to loamy sand about 6 inches thick. The subsoil is very pale brown, very cobbly sandy loam to loamy sand about 10 inches thick. The substratum, a very pale brown, very cobbly sandy loam to loamy sand, overlies bedrock at a depth of 2 to more than 5 feet.

CLASSIFICATION REMARKS Soils are Cryochrepts or Cryorthents. The most common subgroups are Dystric Cryochrepts, Typic Cryochrepts, and Typic Cryorthents. Included similar soils are Lithic Cryochrepts and Pergilic Cryochrepts. Soil families include loamy skeletal and sandy skeletal partical size classes.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation and slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on steep cutbanks and is too rocky for use as native road surface. Revegetation of cut and fill slopes is limited by exposed bedrock and extremely stony droughty material. Special practices can be required to reestablish vegetation. Avelanches can increase maintenance costs.

RANGE The unit is poorly suited to range management. It produces little forage and slope steepness severity limits access.

WILDLIFE-FISHERIES This unit is potentially good summer and fall habitat for bighorn sheep and mountain goat. Included wind swept ridges are potential winter range. The unit does not normally contain trout habitat but borders streams that do.

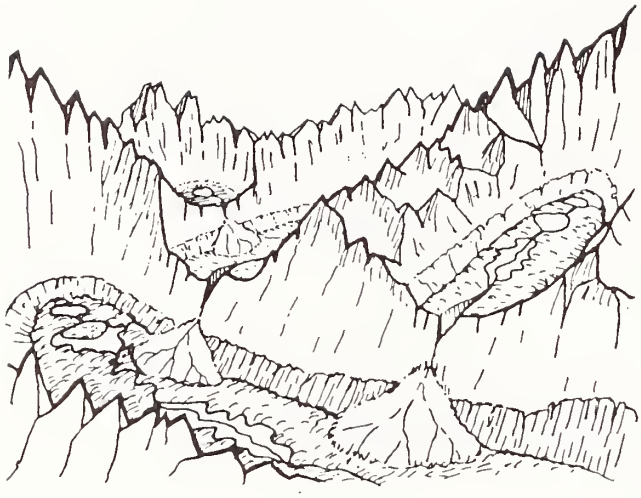
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	high
Sediment Delivery Efficiency	high
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	low

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B, C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, rocky slopes (center of block diagram). Delineations are mainly in the southern Gallatin Range, Madison Range, north and west of Hebgen Lake, western Absaroka-Beartooth Range, and eastern Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of moderately coarse and moderately fine textured soils and rock outcrop. The soils have formed in materials weathered from thickly bedded sandstone and shale. Native vegetation is lower subalpine forest.

ADJOINING M.U. Adjacent units are moderately steep valley toe slopes and bottoms.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,600-8,500	20

The unit consists of steep, rocky slopes forming the irregular concave sidewalls of U-shaped valleys and headwalls around cirque basins. Springs and seeps are common. Landslides are often associated with seeps and springs. Bedrock outcrops form occasional cliffs and numerous ledges. Bouldery rubble occurs at the base of slopes and below bedrock outcrops. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with high channel gradients. These landforms have a severe landslide hazard. Upper slopes have little subsurface water storage capacity and delivery of run-off to streams is rapid. Lower slopes have high subsurface water storage capacity and surface runoff leaves the unit rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of a complex of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twin flower (ABLA/LIBO) - 50 percent, and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 15 percent. Included HTs with dissimilar management implications are subalpine fir/bluejoint (ABLA/CACA); subalpine fir whitebark pine/grouse whortleberry (ABLA-PIAL/VASC), and Douglas-fir/snowberry (PSME/SYAL) - 15 percent.

HABITAT TYPE DISTRIBUTION The major HTs ABLA/VASC and ABLA/VAGL are on drier parts of the unit. ABLA/LIBO occupies moist northern exposures. FEID/AGCA occurs in scattered mountain meadows. Subalpine fir/heartleaf arnica (ABLA/ARCO) is included as similar. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. ABLA/CACA is on moist sites adjoining seeps and is a more productive timber site. ABLA-PIAL/VASC is on cold upper elevation sites and is a less productive timber site. PSME/SYAL is on warm, lower elevation sites where moisture stress limits regeneration.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered meadows and rock outcrop. The forest understory is a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry. The meadows contain bearded wheatgrass, Idaho fescue, western needlegrass and timber oatgrass.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded sandstone and shale - 80 percent; and limestone - 20 percent.

The bedrock consists of thick beds of light colored sandstone and multi-colored shales. This shale adds color to the local landscape. Typical geologic formations are the Quadrant formations of the Ellis group, Morrison, Kootenai, and Mowry-Thermopolis of Pennsylvanian to upper Cretaceous ages. The limestone is most often from the Madison group of Mississippian age. The sandstone and limestone form ridges and outcrops. Thinly bedded sandstones and shales are included as similar bedrock. Landslide hazards are associated with the shale beds. Seeps often occur along the contact between sandstone and shale.

An included bedrock with dissimilar properties is white bentonitic shale of the Albino formation. Higher landslide hazards are associated with this bedrock.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately fine and moderately coarse textures. Subsoils contain 20-65 percent flat or subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of soils and rock outcrop. Rock outcrop and rubble occupy 20 percent of the unit.

Soil properties vary with parent material. Soils formed in material weathered from shale are moderately fine textured with 20 to 35 percent rock fragments in the subsoil and subsoil clay accumulations. Included similar soils have more rock in the subsoil. These soils occupy 30 percent of the unit. Soils formed in material weathered from sandstone are moderately coarse textured with 35 to 65 percent rock fragments in the subsoil. These soils occupy 30 percent of the unit.

Included are small areas of dissimilar soils. Soils with dark colored surface layers are in meadows and occupy 10 percent of the unit. Also included are somewhat poorly drained soils that support water tolerant plants. These soils have lower bearing strength.

GENERAL DESCRIPTION The surface of the moderately fine textured soils is covered by a partially decomposed forest litter layer about 1 inch thick. The surface layer is very pale brown loam about 4 inches thick. The subsoil is yellowish brown, gravelly clay loam about 14 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths of 2 to more than 5 feet. Soil colors vary with parent material color. See soil description 3 for more detail.

The surface of the moderately coarse textured soils is covered by a partially decomposed forest litter layer about 1 inch thick. The surface layer is brown, gravelly loam about 4 inches thick. The subsoil is very pale brown, very cobbly sandy loam about 10 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The moderately fine textured soils are Typic Cryoboralfs, fine loamy mixed. Included similar soils are Typic Cryoboralfs, loamy skeletal, mixed. The moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed.

The included dissimilar meadow soils are Argic Cryoborolls, fine loamy, mixed. The somewhat poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 53 to 71 cu. ft./acre. Slope steepness and rock outcrop severely limit equipment use. Cable yarding systems can overcome this limitation. Rock fragments in the moderately coarse textured soils make planting difficult.

ROADS The unit is poorly suited to road construction. Slope steepness increases the quantity of material excavated. Unstable slopes occur frequently. Slope stability should be evaluated before locating roads. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. Livestock tend to concentrate on small included less sloping areas. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The forest understory produces little forage.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall elk, moose and grizly bear habitat. The unit also provides fair winter bighorn sheep and elk habitat in lower Douglas fir forests. The unit does not normally contain trout habitat but borders streams that do.

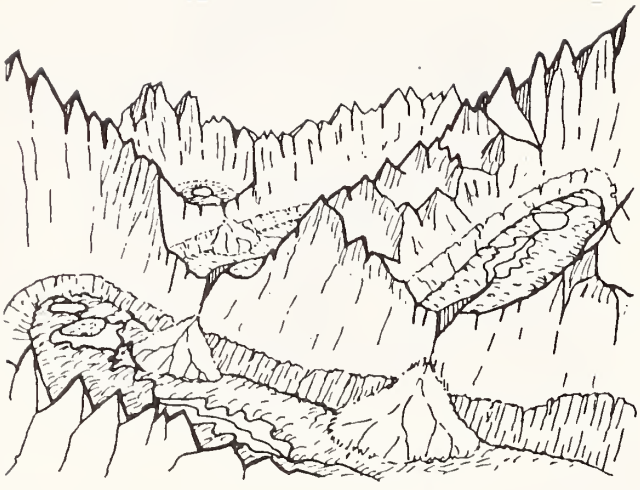
INTERPRETATIONS

Landslide Hazards	high
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	none
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep rocky, slopes (center of block diagram). Delineations are mainly in the Gallatin Range, and in the Gardiner and Mill Creek area of the Absaroka-Beartooth Range,

M.U. COMPONENTS The unit contains a complex of medium textured soils and rock outcrop. They have formed in material from volcanic rock. Native vegetation is lower subalpine forest with a few mountain grasslands.

ADJOINING M.U. Adjacent units are gently sloping to moderately steep valley bottoms or rocky slopes with "timberline" vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	7,600-8,500	25

The unit consists of steep, irregular, concave, rocky slopes. These slopes form the sidewalls of U-shaped valleys and headwalls around cirque basins. Avalanche paths and rock slides are occasionally present. Bedrock outcrops form occasional cliffs and numerous ledges. Bouldery talus is at the base of slopes and below bedrock outcrops. Scree is also common at the base of steep slopes. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel pattern with high channel gradients. These landforms have moderate landslide hazards and slopes may unravel. They have low subsurface water storage capacity on upper slopes and surface runoff occurs during snowmelt and intense storms. Storage capacity is high on lower slopes and surface runoff leaves the unit rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit is an association of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/pine grass (ABLA/CARU) - 50 percent; Douglas-fir/pine grass (PSME/CARU) and Douglas-fir/snowberry (PSME/SYAL) - 15 percent. Included HTs with dissimilar management implications are Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL are on northern exposures. ABLA/CARU is on southern exposures at higher elevations. PSME/CARU and PSME/SYAL are at lower elevations. Subalpine fir/heartleaf arnica (ABLA/ARCO) is included as a similar HT at higher elevations and Douglas-fir/ninebark (PSME/PHMA) is included as a similar HT at lower elevations. Cool, climates and low to moderate timber productivity are associated with these HTs in this unit.

Included are 10 percent dissimilar HTs. FEID/AGSP occurs in parks and is a grassland. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site.

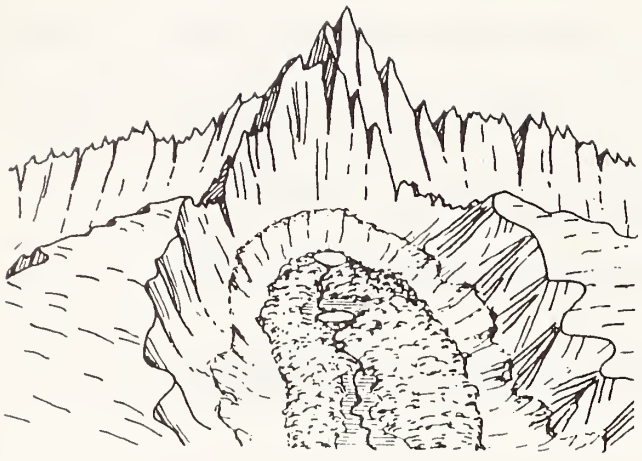
EXISTING VEGETATION consists of dense lodgepole pine forest with scattered mountain grassland parks. The forest understory is a thick mat of shrubs and grasses. Grouse whortleberry, blue huckleberry and pinegrass are dominant. The parks contain Idaho fescue, bluebunch wheatgrass and common forbs.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 90 percent; and hard crystalline bedrock 10 percent.

The principal bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and some welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are more resistant while the tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs.

Included bedrock with dissimilar properties is gneiss of Precambrian age. The material weathered from these rocks is more erodible.



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 25-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, semi-circular shaped basins (center of block diagram). Delineations are mainly at upper elevations of all mountaon ranges in the survey area.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured. They have formed in glacial till deposits and material weathered from hard crystalline rock. Native vegetation is alpine meadow with patches of stunted timberline forest.

ADJOINING M.U. Adjacent units have steep rocky slopes or moderately dense, upper subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	East or Northwest	8,000+	10-30

The unit consists of glacial cirque basins at the head of U-shaped valleys. These basins occasionally contain small ponds or lakes. Slopes are nearly level to rolling. Bedrock outcrops are rounded and form subdued knobs throughout the unit. Rubble is common at the base of adjacent headwalls. These basins are dissected by numerous, poorly defined perennial and intermittent streams. The drainage system has a deranged pattern. There are many seeps, springs, and bogs. These landforms have moderate subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCCURRENCE The unit consists of Idaho fescue/tufted hairgrass (FEID/DECA) - 55-60 percent; whitebark pine - subalpine fir (PIAL-ABLA) - 10-20 percent. An included HT with dissimilar management implications is tufted hairgrass/sedges (DECA/CAREX) - 5-10 percent.

HABITAT TYPE DISTRIBUTION FEID/DECA and PIAL-ABLA occur throughout the unit. Very cold, alpine climates, and very low timber and moderate range site productivity are associated with these HTs in this unit.

An included dissimilar HT, DECA/CAREX, occurs on poorly drained soils around bogs, springs, and lakes, and is a more productive range site.

EXISTING VEGETATION consists of a mosaic of alpine meadow with scattered stands of stunted subalpine fir, Engelmann spruce and whitebark pine. The harsh alpine climate limits the height of the meadow vegetation to less than 6 inches. Growth forms resemble arctic tundra. Mountain meadows contain tufted hairgrass, Idaho fescue , sedges and abundant forbs. The understory in forested areas is very sparse and consists of scattered heartleaf arnica and lupine.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 100 percent. The hard crystalline bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. Thin glacial till deposits, considered similar to bedrock weathering products, occur on concave slopes. The surface is frequently mantled by a thin layer of silty loess.

An included bedrock with dissimilar properties is micaceous schist of Precambrian age. Soils formed in material weathered from schist are finer textured and more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well to somewhat excessively drained, with moderately coarse textures. Subsoils contain more than 50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of soils and rock outcrop. Rock outcrop and talus occupy 10-30 percent of the unit and occur throughout. Talus slopes often occur below cirque headwalls.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately coarse textures. Subsoils contain more than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex of soil and rock outcrop or rubble. Rock outcrop and rubble occupy 20 percent of the unit and occur on ridges.

The major soils are deep and slightly to moderately acid. Included similar soils are more acid, shallower or coarse textured. The more acid soils are at upper elevations, and shallow soils are near rock outcrops. The coarse textured soils are not obviously associated with landscape features. These soils occupy 55 percent of the unit.

Small areas of dissimilar soils are included. Poorly drained soils occur along drainageways. They are more productive timber sites and have lower bearing strength. Moderately fine textured soils are in areas underlain by micaceous schist. They are more productive timber sites. These soils occupy 25 percent of the unit.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter less than 1 inch thick. The surface layer is brown, gravelly loam about 3 inches thick. The subsoil is pale brown, very cobbly sandy loam about 15 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths of 3 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils are Cryochrepts. Included are Typic Cryochrepts, loamy skeletal mixed; Dystric Cryochrepts, loamy skeletal, mixed; Lithic Cryochrepts, loamy skeletal, mixed; and Typic Cryochrepts, sandy skeletal, mixed.

The included dissimilar poorly drained soils are Typic Cryaquolls, loamy skeletal, mixed. The moderately fine textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. Potential annual production is 53 to 71 cu. ft./acre. Under certain moisture conditions, equipment operation may compact and rut the soil. This limitation may be overcome by using equipment only when the soil is dry or covered with snow, or by using cable yarding systems. Rock fragments on the soil surface make planting difficult.

ROADS The unit is moderately suited to road construction. Shallow, non-rippable bedrock moderately limits excavation. The frequent bogs, springs and wet stream bottoms have low bearing strength. These poorly drained areas affect road placement. Material exposed by road construction is erodible and tends to unravel on steep cutbanks. Revevetation of cut and fill slopes and surfacing help overcome these limitations. Native road surfaces on ridgetops are rough.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. The unit is poorly suited for use as range following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good summer elk moose and grizzly bear habitat. It provides good security cover. Only major streams within the unit normally contain trout habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Production	low
Grassland and shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	30-60
Spring Runoff	June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	A, B

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium textures. Subsoils contain more than 35 percent subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex of soils and rock outcrop. Rock outcrop and talus occupy 25 percent of the unit and occur throughout.

The soils are deep medium textured soils with light colored surface layers. Shallow soils adjacent to rock outcrops are included as similar. These soils occupy 50 percent of the unit.

Small areas of dissimilar soils are included. Moderately fine textured soils with subsoil clay accumulations occur on lower northern exposures. They occupy 20 percent of the unit and are more productive timber sites. Soils with dark colored surface layers are in grassland parks. They occupy 5 percent of the unit and are range sites.

GENERAL DESCRIPTION The surface of the major soil is covered with a mat of partially decomposed forest litter less than 1 inch thick. The surface layer is brown, gravelly loam about 3 inches thick. The subsoil is reddish brown, very cobbly loam about 20-30 inches thick. The substratum, a reddish brown very cobbly loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Lithic Cryochrepts, loamy skeletal, mixed.

The included dissimilar moderately fine textured soils are Typic Cryoboralfs, loamy skeletal, mixed. The grassland soils are Argic Cryoborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 33-53 cu. ft./acre. Slope steepness and rock outcrop severely limit equipment use. Cable yarding systems may overcome this limitation. Rock outcrop limits felling and slash disposal operations. Rock fragments on the surface or in the soil make planting difficult.

ROADS The unit is poorly suited to road construction. Non-rippable rock severely limits excavation. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special practices may be required to reestablish vegetative cover.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall mountain goat and bighorn sheep habitat. It provides good security cover for elk and deer. The unit does not normally contain trout habitat but borders streams that do.

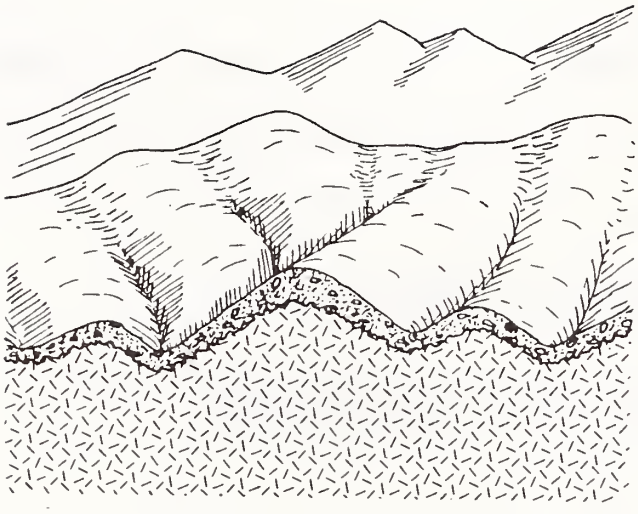
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	slight
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 22-3C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of high elevation, nearly level to hilly, subdued ridges (block diagram). Delineations are mainly in the northern Madison Range, north of Absaroka-Beartooth Range, and the Cooke City area of the Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured. They have formed in material weathered from hard crystalline rock. Native vegetation is dense lower subalpine forest with some wet meadows.

ADJOINING M.U. Adjacent units have steeper slopes or sparse subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,200-8,600	20

The unit consists of irregular, nearly level to hilly convex ridges. These ridges are separated by very narrow, gently sloping valleys with concave side slopes. Bedrock outcrops are rounded and often occur on ridgetops. These ridges are dissected by well defined perennial streams. The drainage system has a partially deranged or dendritic pattern with very low channel gradients. Small lakes, ponds and bogs occur throughout the unit. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/blue huckleberry (ABLA/VAGL) - 65 percent. Included HTs with dissimilar management implications are subalpine fir/blue joint (ABLA/CACA), subalpine fir - whitebark pine/grouse whortleberry (ABLA-PIAL/VASC), and tufted hairgrass/sedge (DECA/CAREX) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. Similar included HTs are subalpine fir/heartleaf arnica (ABLA/ARCO) and subalpine fir/twinflower (ABLA/LIBO). Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. ABLA/CACA occurs on poorly drained soils and is a more productive timber site. ABLA-PIAL/VASC occurs at high elevations and is a less productive timber site. DECA/CAREX is in wet meadows.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered wet meadows. Forests typically occupy upper slopes with meadows in gently sloping valleys or other depressional positions. The wet meadows contain tufted hairgrass and numerous sedges. The forest understory is composed of a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 90 percent; volcanic bedrock - 10 percent

The bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. Some glacial till deposits are included as similar to material weathered from the underlying bedrock. These deposits are in depressional positions.

Included bedrocks with dissimilar properties are micaceous schist of Precambrian age and volcanic bedrock of Tertiary age. The material weathered from these rocks is more erodible.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of soils and rock outcrop. Rock outcrop and talus occupy 10-30 percent of the unit and occur throughout. Talus slopes often occur below cirque headwalls.

The unit contains shallow to moderately deep acid soils. Soil depth varies from less than 20 inches near rock outcrops to 20-40 inches on the rest of the landscape.

Small areas of dissimilar soils are included. Poorly drained soils occur near seeps and springs or along the margins of lakes and occupy 15 percent of the unit. They have lower bearing strength and are more productive range sites.

GENERAL DESCRIPTION Soils are light colored and moderately to strongly acid. Soil depth varies from less than 20 inches near rock outcrops to more than 40 inches. Surface layers are often formed in thin silty loess layers. Subsoil texture varies from moderately coarse to coarse.

CLASSIFICATION REMARKS The soils are Cryochrepts. The most common subgroups are Dystric Cryochrepts and Lithic Cryochrepts. Included similar soils are Typic Cryochrepts and Pergelic Cryochrepts.

The included poorly drained soils are Cryaquepts and Cryaquents.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. The material exposed by road construction tends to unravel on steep cutbanks. The harsh climate limits revegetation of cut and fill slopes. Special revegetation practices and annual maintenance of the road drainage system help control erosion. Snow cover limits use of roads during much of the year.

RANGE The unit is poorly suited to range management. The potential native plant communities produce about 1,230 pounds per acre of air dry herbage in normal years. Snow cover much of the year and low soil bearing strength severely limit the grazing season. Delaying grazing in the spring until the soil has dried helps prevent trampling damage to the vegetation and soil. Loose herding of sheep is particularly important for proper forage utilization in these alpine meadows.

WILDLIFE-FISHERIES The unit is potentially good summer elk, grizzly bear, mountain goat, and bighorn sheep habitat. It is potentially fair summer and fall mule deer and moose habitat. Streams within this unit contain some trout habitat. The lakes do contain trout habitat.

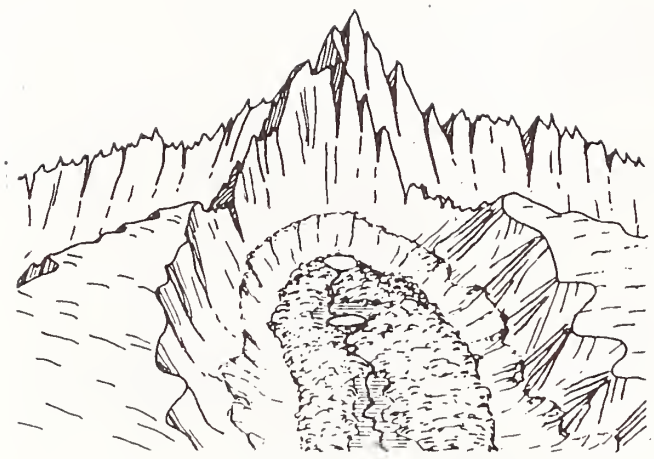
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	high
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 25-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, semi-circular shaped basins (center of block diagram). Delineations are mainly in the Gallatin Range, Bridger Range, with some in the Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured. They have formed in glacial till deposits and material weathered from volcanic or sedimentary rock. Native vegetation is alpine meadow and patches of stunted timberline forest.

ADJOINING M.U. Adjacent units have steep rocky slopes or moderately, dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	8,000+	25

The unit consists of glacial cirque basins at the heads of U-shaped valleys. These basins occasionally contain small ponds or lakes. Slopes are nearly level to rolling. Bedrock outcrops are rounded and form subdued knobs throughout the unit. Rubble is common at the base of adjacent headwalls. These basins are dissected by numerous, poorly defined perennial and intermittent streams. The drainage system has a deranged pattern. There are many seeps, springs, and bogs. The landforms have moderate subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consist of a complex of Idaho fescue/tufted hairgrass (FEID/DECA) -30 percent; and whitebark pine - subalpine fir (PIAL-ABLA) - 30 percent. An included HT with dissimilar management implications is tufted hairgrass/sedges (DECA/CAREX) - 15 percent.

HABITAT TYPE DISTRIBUTION FEID/DECA and PIAL-ABLA occur throughout the unit. Cold alpine climates and moderate range site productivity are associated with these HTs in this unit.

An included dissimilar HT, DECA/CAREX, occurs on poorly drained soils around bogs, springs, and seeps and is a more productive range site.

EXISTING VEGETATION consists of a mosaic of alpine meadow with scattered stands of stunted subalpine fir, Engelmann spruce, and whitebark pine. The alpine climate limits the growth of meadow vegetation to less than 6 inches. Growth forms resemble arctic tundra. Tufted hairgrass, Idaho fescue sedges and abundant forbs are common meadow plants. The understory in forested areas is very sparse and consists of scattered heartleaf arnica and lupine.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 80 percent and sedimentary bedrock - 20 percent.

The volcanic bedrock consists of a repetitive sequence of lava flows and mudflow breccias of Tertiary age. The sedimentary bedrock consists of limestone with some interbedded sandstone and shale. The limestone is most often from the Madison group of Mississippian age. The sandstone and shale are typically of cretaceous or Jurassic age. Thin glacial till deposits occur on some slopes. The surface is frequently mantled by a thin layer of silty loess.

Included bedrocks with dissimilar properties are hard crystalline rocks. Material weathered from hard crystalline rocks is coarser textured and more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures. Subsoils contain 10-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex pattern of soil and rock outcrop. Rock outcrop and talus occupy 25 percent of the unit and occur throughout. Talus slopes often occur below cirque headwalls.

The unit contains shallow to deep, slightly to moderately acid soils with dark to light colored surface layers. Soil depth varies from less than 20 inches near rock outcrops to more than 40 inches. Soils on concave slopes have dark colored surface layers. Soils with lighter colored surface layers occur on convex slopes near rock outcrops. These soils occupy 60 percent of the unit.

Small areas of dissimilar soils are included. Poorly drained soils occur near seeps and springs or along the margins of lakes and occupy 15 percent of the unit. They have lower bearing strength.

GENERAL DESCRIPTION See soil classification section for descriptions of Cryoborolls and Cryoboralfs.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Cryoborolls. The most common subgroups are Argic Cryoborolls and Argic Pachic Cryoborolls. Included similar soils are Typic Cryoborolls and Lithic Cryoborolls. The soils with light colored surface layers are Cryoboralfs. The most common subgroup are Typic Cryoboralfs and Mollic Cryoboralfs.

The included dissimilar poorly drained soils are Cryaquolls, usually Argic Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. The material exposed by road construction is erodible and tends to ravel on steep cutbanks. The harsh climate limits revegetation of cut and fill slopes. Special practices may be required to reestablish vegetation. Annual maintenance helps keep the drainage system operating. Unsurfaced roads rut when wet. Surfacing or seasonal closures overcome this limitation. Snow cover limits use of roads during much of the year.

RANGE The unit is poorly suited to range management. The potential native plant communities produce about 1,365 pounds per acre of air dry herbage in normal years. Snow cover much of the year and low soil bearing strength limit the grazing season. Delaying grazing in the spring until the soil has dried helps prevent trampling damage to the vegetation and soil. The included poorly drained soils are susceptible to trampling damage all year.

WILDLIFE-FISHERIES The unit is potentially good summer elk, mountain goat, bighorn sheep, and grizzly bear habitat. Potentially fair summer and fall mule deer and moose habitat is also available. Streams within the unit contain some trout habitat. Mountain lakes often contain good habitat.

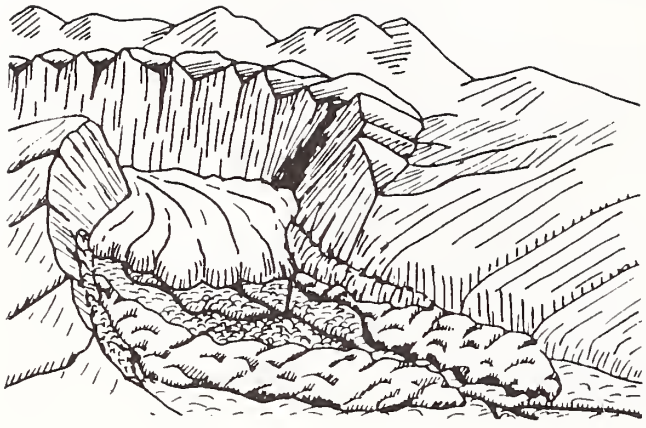
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling hummocky valley bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains, southern Absaroka-Beartooth Range, and in the Madison Range.

M.U. COMPONENTS Soils are medium and moderately coarse textured. They have formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is open grown to sparse upper subalpine forest.

ADJOINING M.U. Adjacent units have steep rocky slopes, or steep glacial till deposits with dense or sparse subalpine forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,600-8,500	10

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located in the bottoms of U-shaped valleys or basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued rock outcrops are common. These till deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Some tributary streams cascade into these units from adjacent hanging valleys. Small lakes, ponds, and bogs occur throughout the unit. The landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 80 percent, Included dissimilar HTs are subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/heartleaf arnica (ABLA/ARCO) - 10 percent.

HABITAT TYPE DISTRIBUTION The major HT ABLA-PIAL/VASC occurs throughoutithe unit. The similar HT whitebark pine-subalpine fir (PIAL-ABLA) is at upper elevations. Cold climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/VASC and ABLA/VAGL are at lower elevations. ABLA/ARCO is scattered in protected areas. These HTs are more productive timber sites.

EXISTING VEGETATION consists of a dense forest of stunted whitebark pine, subalpine fir, and Engelmann spruce forest. Dense stands of lodgepole pine are at lower elevations. The understory is composed of moderately sparse mats of grouse whortleberry or heartleaf arnica.

GEOLOGY

OCCURRENCE The unit contains glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. Soils formed in these deposits are moderately coarse textured and contain many rock fragments. The till substratum is highly erodible.

Included are small areas of dissimilar finer textured less erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well to somewhat excessively drained, moderately acid and moderately coarse textured. Subsoils contain 15-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of very gravelly or cobbly soils with light colored surface layers. Included similar soils have fewer subsoil rock fragments, darker colored surface layers, or less acid subsoils. The soils containing fewer rock fragments are not obviously associated with landscape features. The soils with darker surface layers are near seeps and depressions. The soils with less acid subsoils are at lower elevations.

Small areas of dissimilar soils are included. Moderately fine textured soils formed in finer textured glacial till occupy 10 percent of the unit. These soils are more productive timber sites and less erodible. Included also are small areas of poorly drained soils. They are in depressions or near seeps and occupy 5 percent of the unit. These soils have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter less than one inch thick. The surface layer is brown very gravelly loam about 4 inches thick. The subsoil is pale brown, very cobbly sandy loam about 14 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths of greater than 5 feet. See soil descripton 23 for more detail.

CLASSIFICATION REMARKS The major soils are Dystric Cryochrepts, loamy skeletal, mixed. The included similar soils are Dystric Cryochrepts, coarse loamy, mixed; Typic Cryumbrepts, loamy skeletal, mixed; and Typic Cryochrepts, loamy skeletal, mixed.

The included dissimilar soils with moderately fine textured subsoils are Mollic Cryoboralfs, loamy skeletal, mixed. The poorly drained soils are Argic Cryaquolls, fine, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-32 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is severely limited because of the subalpine climate. This limitation is difficult to overcome. Individual trees are often poorly formed and may have spiral grain.

ROADS The unit is well suited to road construction. The material exposed by road construction is erodible and tends to ravel on steep cutbanks. Seeding cut and fill slopes and annual maintenance of the drainage system help to control erosion.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. The unit is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and grizzly bear habitat. It provides good security cover when stands are sapling pole size. It is potentially good fall and winter blue grouse habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat.

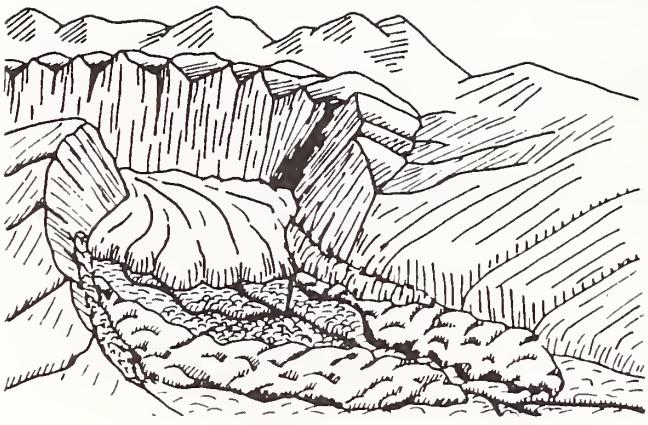
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Production	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	Under 50
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of hummocky valley bottoms (center of block diagram). Delineations are mainly in the Absaroka-Beartooth Range and near Hebgen Lake.

M.U. COMPONENTS The unit contains an association of soils. Soils are moderately coarse to medium textured. They have formed in glacial till deposits. Native vegetation is mountain shrubland with some open grown Douglas fir forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or glacial till deposits with dense or sparse Douglas fir forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Southern	6,500-7,500	5

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottom of U-shaped valleys or basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. A few rounded, subdued rock outcrops are included. These valleys are dissected by well defined intermittent streams. The drainage system has a dendritic or deranged pattern with moderate channel gradients. These landforms are stable. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID)) - 75 percent and Douglas fir/Idaho fescue (PSME/FEID) - 10 percent. Included HTs with dissimilar management implications are Douglas fir/snowberry (PSME/SYAL), subalpine fir/blue huckleberry (ABLA/VAGL) and low sage/Idaho fescue (ARAR/FEID) - 10 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID dominates the unit. PSME/FEID and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) are included similar HTs. Warm, dry climates and moderate range productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. PSME/SYAL and ABLA/VAGL are on northern exposures at higher elevations. Low timber productivity is associated with these HTs in this unit. Low sage/Idaho fescue (ARAR/FEID) occurs near Gardiner and has much lower range productivity.

EXISTING VEGETATION consists of mountain shrublands with scattered Douglas-fir stands. The shrubland has a moderately dense canopy of big sagebrush with an understory dominated by Idaho fescue, bluebunch wheatgrass and junegrass. In the Douglas-fir stands, the understory is composed of shrubs and bunchgrass.

GEOLOGY

OCCURRENCE The unit contains glacial till - 100 percent. The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. Soils formed in these deposits are moderately coarse textured and contain many rock fragments. The till is highly erodible.

Included are small areas of finer textured less erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and have dark colored surface layers. They have moderately coarse and medium textures. Subsoils contain more than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an undifferentiated group of soils. Soil properties vary with the texture of the glacial till deposits. Soils formed in finer textured till have accumulations of clay in the subsoil. Soils formed in coarse textured till have no subsoil clay accumulations. Soils with subsoil clay accumulations occur near Hebgen Lake and Gardiner. Soils without subsoil clay accumulations occur in the Absaroka Range. Included in both areas are similar soils with very thick dark colored surface layers in swales and depressions.

Small areas of dissimilar soils with light colored surface layers are included. These soils are in forested areas and are less erodible.

GENERAL DESCRIPTION The soils with subsoil clay accumulation have brown, gravelly loam surface layers about 7 inches thick. Subsoils are brown, gravelly sandy clay loam about 12 inches thick. The substratum, a light yellowish brown, stony sandy loam, overlies bedrock at depths of greater than 5 feet. See soil description 17 for more detail.

The soils without subsoil clay accumulation have dark grayish brown, gravelly sandy loam surface layers about 8 inches thick. Subsoils are brown, very cobbly sandy loam about 8 inches thick. The substratum, a brown, very cobbly sandy loam, overlies bedrock at depths of greater than 5 feet. See soil description 14 for more detail.

CLASSIFICATION REMARKS The soils with subsoil clay accumulations are Argic Cryoborolls, loamy skeletal, mixed. Included as similar are Argic Pachic Cryoborolls, loamy skeletal, mixed. The soils without subsoil accumulations are Typic Cryoborolls, loamy skeletal, mixed. Included as similar are Pachic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils with light colored surface layers are Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, loamy skeletal mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. The material exposed by road consruction is erodible and tends to ravel on steep cutbanks. Annual maintenance helps keep the drainage system operating. Seeding cut and fill slopes helps control erosion.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,400 pounds per acre of air dry herbage in normal years. Lower productivity is associated with low sage/Idaho fescue habitat types near Gardiner. The forest understory produces some forage. Forage production increases following timber harvest and the unit is well suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good winter elk habitat, spring grizzly bear habitat and year long mule deer habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

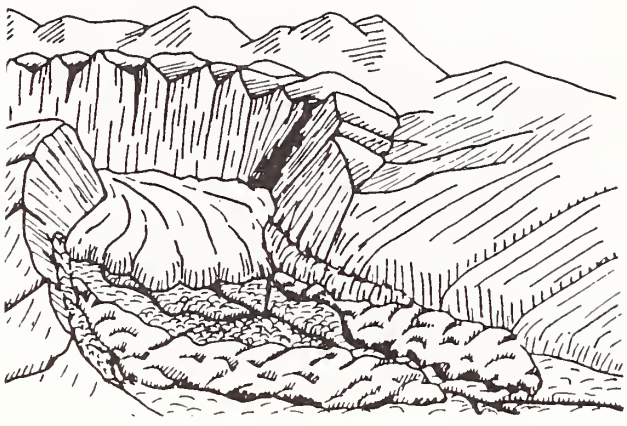
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	very low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Production	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	120+
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of hummocky valley bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains, Absaroka-Beartooth Range, Madison Range, Gallatin Range, and north of Hebgen Lake.

M.U. COMPONENTS Soils are moderately coarse to medium textured with weakly expressed horizons. They have formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or steep glacial till deposits with dense or sparse subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Northern	6,700-7,900	10

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued rock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Some tributary streams cascade into these units from adjacent hanging valleys. Small lakes, ponds, and bogs occur occasionally throughout the unit. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/pine grass (ABLA/CARU) - 80 percent. Included HTs with dissimilar management implications are subalpine fir/bluejoint (ABLA/CACA) and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/CARU is only on southern exposures. Subalpine fir/heartleafed arnica (ABLA/ARCO) and subalpine fir/twinflower (ABLA/LIBO) are similar included HTs. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/CACA occurs near lakes, ponds, and bogs and is more productive. ABLA-PIAL/VASC occurs at higher elevations, is less productive, and has severe climatic limitations to regeneration.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of a thick mat of grouse whortleberry, blue huckleberry and pinegrass.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. These deposits are moderately coarse to medium textured and contain many rock fragments. They are moderately erodible.

Included are some finer textured less erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and have light colored surface layers. They have moderately coarse and medium textures. Subsoils contain more than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of very gravelly or cobbly, slightly acid soils with light colored surface layers. Included similar soils are moderately acid or contain fewer rock fragments. These soils occupy 75 percent of the unit. The soils which contain fewer rock fragments are not obviously associated with landscape features. The moderately acid soils are at higher elevations.

Small areas of dissimilar soils are included. Soils with moderately fine textures form in finer textured glacial till and occupy 10 percent of the unit. They are more productive timber sites. Included also are small areas of poorly drained soils. They are in depressional areas near seeps and occupy less than 5 percent of the unit. They have lower bearing strength and are more productive. Delineations in the Crazy Mountains can consist entirely of these soils.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter less than one inch thick. The surface layer is light brown, very gravelly loam about 3 inches thick. The subsoil is very pale brown, very cobbly sandy loam about 29 inches thick. The substratum, a very pale brown, very cobbly or very bouldery sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Dystric Cryochrepts, loamy skeletal, mixed and Typic Cryochrepts, coarse loamy, mixed.

The included moderately fine textured dissimilar soils are Typic Cryoboralfs, loamy skeletal, mixed. The included poorly drained soils are Argic Cryaquolls, fine, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53-71 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is slightly limited because of moisture stress. Designing cutting units to prolong snow melt or creating shade with logging slash can help overcome this limitation. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation may be overcome by using equipment only when the soil is dry or covered with snow.

ROADS The unit is well suited to road construction. The material exposed by road construction is erodible and tends to ravel on steep cutbanks. Revegetation of cut and fill slopes and annual maintenance of the drainage system help control erosion.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. The unit is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good summer and fall moose habitat. It is potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat.

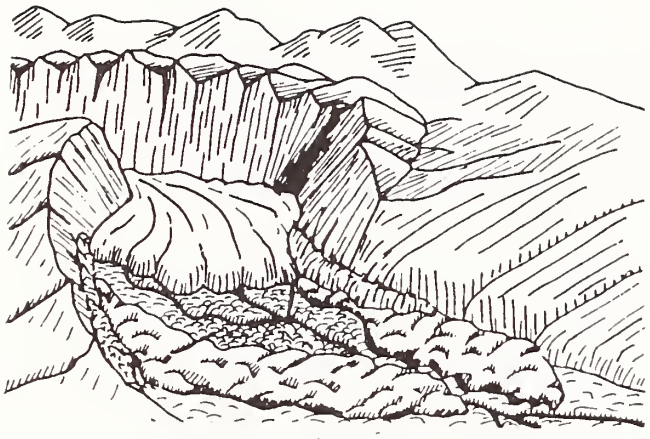
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Production	very low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	April-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-1D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations are mainly near Hebgen Lake and on the eastern fringes of the Absaroka-Beartooth Mountains.

M.U. COMPONENTS The unit contains a complex of soils. Soils are moderately coarse to medium textured. They have formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is open grown to dense Douglas-fir forest with some mountain shrubland parks.

ADJOINING M.U. Adjacent units have steep, rocky slopes or have dense subalpine forest or grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	6,500-7,500	5

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined intermittent streams. The drainage system has a dendritic or deranged pattern with moderate channel gradients. Small lakes, ponds, or bogs occur occasionally throughout the unit. The landforms have high subsurface water storage capacity and runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/snowberry (PSME/SYAL), and Douglas-fir/ninebark (PSME/PHMA), and Douglas-fir/Idaho fescue (PSME/FEID) - 80 percent. Included HTs with dissimilar management implications are subalpine fir/blue huckleberry (ABLA/VAGL) and big sagebrush/Idaho fescue (ARTR/FEID) - 15 percent.

HABITAT TYPE DISTRIBUTION PSME/PHMA occurs on northern or eastern exposures. PSME/SYAL and PSME/FEID are on southern or western exposures. Cool to warm climates and low timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. ABLA/VAGL occurs on northern exposures at higher elevations and is a more productive timber site. ARTR/FEID occurs in scattered mountain shrubland parks and is a mountain grassland.

EXISTING VEGETATION consists of open grown to dense Douglas-fir forest with scattered shrubland parks. The forest understory is composed of shrubs and bunchgrasses. The shrubland parks have a canopy of big sagebrush with an understory dominated by Idaho fescue. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. Soils formed in these deposits are moderately coarse textured and contain many rock fragments. The till substratum is moderately erodible.

Included are small areas of a dissimilar finer textured glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately coarse and medium textures. Subsoils contain 35-60 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils formed under dense Douglas fir forest have light colored surface layers. These soils occupy 75 percent of the unit. Soils formed under sparse Douglas-fir forest or grassland have dark colored surface layers. Included are similar soils with thick, dark colored surface layers that occur in swales and depressions. These soils occupy 15 percent of the unit.

Small areas of dissimilar soils are included. Soils with subsoil clay accumulation and finer textures are in some swales and depressions and occupy 5 percent of the unit. They are less erodible. Delineations in the Crazy Mountains can consist entirely of these soils.

GENERAL DESCRIPTION The soils with light colored surface layers have light brown, very gravelly loam surface layers about 7 inches thick. Subsoils are very pale brown, very cobbly sandy loam about 13 inches thick. The substratum, very pale brown, very cobbly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 21 for more detail.

The soils with dark colored surface layers have dark grayish brown, gravelly sandy loam surface layers about 8 inches thick. Subsoils are brown, very cobbly sandy loam about 8 inches thick. The substratum, a brown, very cobbly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 14 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryochrepts, loamy skeletal, mixed. The soils with dark colored surface layers are Typic Cryoborolls loamy skeletal, mixed. Included similar soils are Pachic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils with subsoil clay accumulations are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 16 to 50 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited because of moisture sterss. The dry climate may limit natural regeneration to years when seed production is good and precipitation is above average. The understory vegetation competes vigorously with tree seedlings for the limited available water. Use of shelterwood and group selection harvesting systems, site preparation and planting immediately after harvest help overcome this limitation.

ROADS The unit is well suited to road construction. Material exposed by road construction is erodible and tends to ravel on steep cutbanks. Revegetation of cut and fill slopes and annual maintenance of the drainage system help control erosion.

RANGE The unit is poorly suited to range management. The mountain shrubland parks occupy less than 10 percent of the unit but produce more than 90 percent of the forage. Location of forage in widely scattered areas limits accessibility. The forest understory produces little forage, but production increases following timber harvest. The unit is well suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer habitat. It is potentially good blue grouse habitat. Only major streams within the unit normally contain trout habitat.

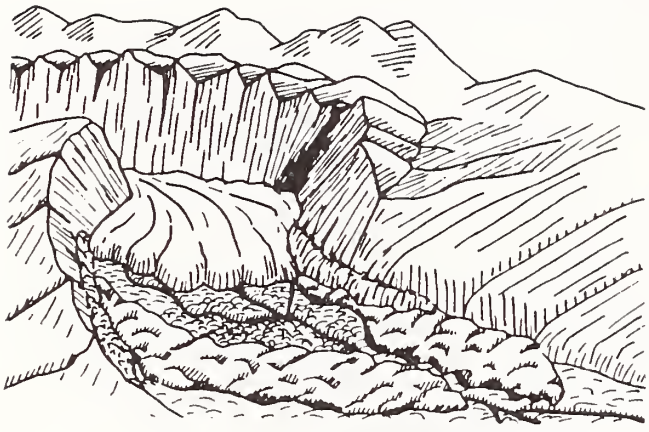
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	March-April
Length of Frost Free Season (days)	120+
Potential Evapotranspiration	Moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations are mainly in the Cinnabar area near Gardiner, in the eastern and southern Madison Range, and south of Hebgen Lake.

M.U. COMPONENTS This unit contains an association of soils. Soils are medium to moderately fine textured. They are formed in glacial till deposits derived from sandstone and shale. Native vegetation is dense to sparse upper subalpine forest and mountain meadows.

ADJOINING M.U. Adjacent units have steep, rocky slopes or are glacial till deposits supporting dense subalpine forests.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	8,000-8,500	5

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops or rubble are common. These valleys are dissected by well defined perennial or intermittent streams. The drainage system has a dendritic or deranged pattern with moderate channel gradients. Small lakes, ponds, or bogs occur throughout the units. These landforms have a moderate landslide hazard. They have high subsurface water holding capacity and runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 50 percent and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 30 percent. Included HTs with dissimilar management implications are subalpine fir/blue huckleberry (ABLA/VAGL) and tufted hairgrass/sedges (DECA/CAREX) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs in forested areas. Whitebark pine-subalpine fir (PIAL-ABLA) is included as a similar HT at higher elevations. Cold climates and low timber productivity are associated with these HTs in this unit. FEID/AGCA occurs in mountain meadows and is a moderately productive range site.

Included are up to 5 percent dissimilar HTs. ABLA/VAGL occurs at lower elevations and is a more productive timber site. DECA/CAREX occurs near seeps and is a more productive range site.

EXISTING VEGETATION consists of a dense forest of stunted whitebark pine, subalpine fir and Engelmann spruce forests or dense lodgepole pine forests with scattered mountain meadows. The forest understory is a moderately sparse mat of grouse whortleberry or heartleaf arnica. The mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium and abundant forbs.

GEOLOGY

OCCURRENCE The unit consists of glacial till deposits - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from limestone, sandstone, and shale. Soils formed in these deposits are medium to moderately fine textured and contain variable amounts of rock fragments.

Included are small areas of dissimilar, moderately coarse textured, more erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain less than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of an association of soils. Soil properties vary with vegetation. Soils formed under forest canopies have somewhat light colored surface layers. Included are similar soils with light colored surface layers or more subsoil rock fragments. These soils occupy 50 percent of the unit. Soils in meadows have dark colored surface layers. Included are similar soils with very thick, dark colored surface layers. They occur in swales and depressions. These soils occupy 35 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with moderately coarse texture occur where the glacial till is coarser textured. They are more erodible. Also included are poorly drained, fine textured soils in wet meadows and near seeps. They have lower bearing strength.

GENERAL DESCRIPTION The soils with somewhat light colored surface layers have light brownish gray, loam surface layers about 14 inches thick. Subsoils are a light yellowish brown, gravelly clay loam about 22 inches thick. The substratum, a brown, sandy clay loam, overlies bedrock at depths greater than 5 feet. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are pale brown, clay loam about 15 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with somewhat light colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed and Mollic Cryoboralfs, loamy skeletal, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Pachic Cryoborolls, loamy skeletal, mixed.

The included moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed. The poorly drained, fine textured soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 32-50 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited because of the harsh climate. Trees are often poorly formed and may have spiral grain.

ROADS The unit is well suited to road construction. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils or limiting road cuts to 5 feet helps avoid cutbank and fill slope sloughing. Unsurfaced roads may become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations. Unstable slopes occur in this unit. Slope stability should be evaluated before planning and locating roads.

RANGE The unit is well suited to range management. Mountain meadows occupy 30 percent of the unit but produce more than 90 percent of the forage. They produce about 2,225 pounds per acre of air dry herbage in normal years. The forested areas produce little forage and are poorly suited for use as transitory range following timber harvest. The grazing season is limited by snow cover. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES This unit is potentially good summer and fall moose, elk, and grizzly bear habitat. It may provide good winter moose habitat if the forest understory contains subalpine fir saplings. It is potentially good blue grouse habitat. Only major streams within the unit normally contain trout habitat.

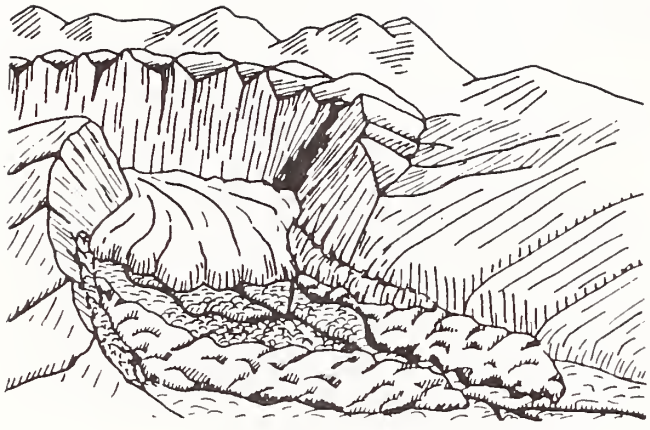
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grasslsnd and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	36-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-2D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations are mainly in the southern Madison Range, the southeast Gallatin Range and the northwest Absarokas.

M.U. COMPONENTS This unit contains an association of soils. Soils are medium to moderately fine textured with subsoil clay accumulations. They are formed in glacial till derived from sandstone and shale. Native vegetation is dense lower subalpine forest and mountain meadows.

ADJOINING M.U. Adjacent units have steep, rocky slopes or glacial till deposits supporting variably dense subalpine vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,000-8,000	5

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined large, perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Small lakes, ponds, and bogs occur throughout these units. These landforms have a moderate landslide hazard. They have high subsurface water storage capacity and runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/grouse whortleberry (ABLA/VASC) - 55 percent; and (Idaho fescue/bearded wheatgrass (FEID/AGCA) - 30 percent. Included HTs with dissimilar management implications are subalpine fir/bluejoint (ABLA/CACA); subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC); Douglas-fir/snowberry (PSME/SYAL); and tufted hairgrass/sedge (DECA/CAREX) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. Subalpine fir/heartleaf arnica (ABLA/ARCO) is included as a similar HT at higher elevations. Douglas-fir/ninebark (PSME/PHMA) is included as a similar HT at lower elevations. Cool, moist climates and low to moderate timber productivity are associated with these HTs.

Included are up to 10 percent dissimilar HTs. ABLA/CACA and DECA/CAREX are on poorly drained soils around seeps and springs and are more productive timber and range sites. ABLA-PIAL/VASC occurs at higher elevations and is on less productive timber sites. PSME/SYAL occurs on southern exposures at lower elevations where moisture stress limits regeneration.

EXISTING VEGETATION consists of dense lodgepole pine forests and scattered mountain meadows. The forest understory is a moderately sparse mat of grouse whortleberry, blue huckleberry and heartleaf arnica. The mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from limestone, sandstone, and shale. These deposits are medium to moderately fine textured and contain variable amounts of rock fragments. Included are small areas of dissimilar moderately coarse textured more erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 20-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils formed under forest canopies, have light colored surface layers and less than 35 percent subsoil rock fragments. Included are similar soils with somewhat darker surface layers or more subsoil rock fragments. These soils occupy 55 percent of the unit. Soils in meadows have dark colored surface layers and more than 35 percent subsoil rock fragments. Included are similar soils with very thick, dark colored surface layers or fewer subsoil rock fragments. These soils occupy 30 percent of the unit.

Small areas of dissimilar soils are included. Soils with moderately coarse textures occur in areas where the glacial till is coarser textured and occupy 10 percent of the unit. These soils are more erodible. Also included are poorly drained, fine textured soils in wet meadows and near seeps. They have lower bearing strength.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown, gravelly loam surface layers about 11 inches thick. Subsoils are pale brown, gravelly clay loam about 12 inches thick. The substratum, a very pale brown, loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 3 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 7 inches thick. Subsoils are pale brown, very gravelly or very cobbly clay loam about 12 inches thick. The substratum, a light yellowish brown, very gravelly or very cobbly clay loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. Included similar soils are Mollic Cryoboralfs, fine loamy, mixed or Typic Cryoboralfs, loamy skeletal, mixed. The soils with dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed. Included as similar soils are classified as Argic Pachic Cryoborolls, loamy skeletal, mixed, or Argic Cryoborolls, fine loamy, mixed.

The included moderately coarse textured dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed. The poorly drained, fine textured soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 45-71 cu. ft./acre. The unit is generally well suited to tractor operation. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation can be overcome by using equipment only when the soil is dry or covered with snow. Competition from forbs and grasses moderately limits regeneration. The limitation is greatest near meadows. Site preparation can help overcome this limitation.

ROADS The unit is well suited to road construction. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils or limit road cuts to 5 feet helps avoid cutbank and fill slope sloughing. Unsurfaced roads may become rutted when wet and dusty when dry. Surfacing or seasonal road closures help to overcome these limitations. Unstable slopes occur in this unit. Slope stability should be evaluated before planning and locating roads.

RANGE The unit is well suited to range management. The mountain meadows occupy 30 percent of the unit and produce more than 90 percent of the forage. The plant communities in mountain meadows produce about 2,225 pounds per acre of air dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The subalpine forests produce little forage and are poorly suited for use as transitory range following timber harvest. The lower elevation forest understories produce moderate amounts of forage and are moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and moose habitat. It is potentially good winter moose habitat when the forest understory contains subalpine fir seedlings. It is potentially fair summer and fall mule deer habitat. Only major streams within the unit normally contain trout habitat. If erosion or landslides occur they are a potential source of sediment which can damage fish habitat.

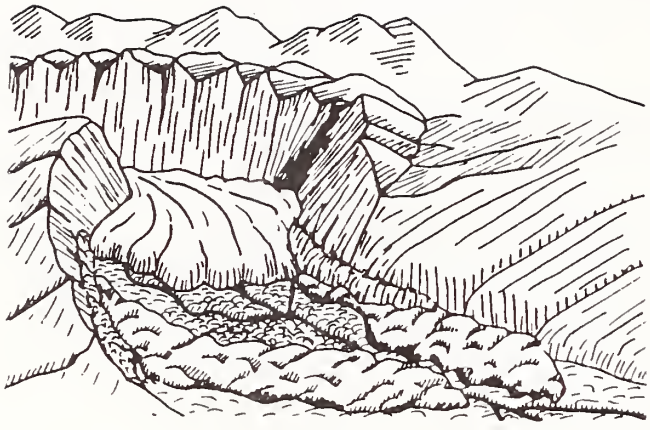
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	low
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling hummocky valley bottoms (center of block diagram). Delineations occur mainly throughout the Gallatin Range, with some in the central Madison Range.

M.U.COMPONENTS This unit contains a medium to moderately fine textured soils with subsoil clay accumulations. They are formed in glacial till deposits derived from volcanic rocks. Native vegetation is open grown to dense upper subalpine forest and mountsin meadows.

ADJOINING M.U. Adjacent units have steep, rocky slopes or steep glacial till deposits supporting dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,800-8,500	10

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Some tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur throughout the unit. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 80 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC), Idaho fescue/bearded wheatgrass (FEID/AGCA) and subalpine fir/bluejoint (ABLA/CACA) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC is the dominant HT. Whitebark pine - subalpine fir (PIAL-ABLA) is included as a similar HT at higher elevations. Cold climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/VASC occurs at lower elevations and is a more productive timber site. FEID/AGCA occurs in mountain meadows and is a range site. ABLA/CACA occurs on poorly drained soils around seeps and bogs and is a more productive timber site.

EXISTING VEGETATION consists of open grown to dense stunted subalpine fir, whitebark pine and Engelmann spruce forest. A few dense stands of lodgepole pine forest occur at lower elevations. The forest understory is a moderately sparse mat of grouse whortleberry. A few mountain meadows and rock outcrops are scattered throughout the unit. The mountain meadows contain bearded wheatgrass, mountain brome and timber oatgrass.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from layered, volcanic rocks. These deposits are medium textured and contain variable amounts of rock fragments.

Included is some dissimilar moderately coarse textured more erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 10-40 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with somewhat dark surface layers and greater than 35 percent subsoil rock fragments. Included similar soils have less than 35 percent subsoil rock fragments or lighter colored surface layers. The included soils are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Small areas of dissimilar soils are included. Soils with moderately coarse textures occur in areas where the glacial till is coarser textured. These soils occupy 10 percent of the unit and are not obviously associated with landscape features. They are more erodible. Also, included are poorly drained, fine textured soils and near seeps. They occupy 5 percent of the unit and have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a layer of partially decomposed forest litter less than 1 inch thick. The surface layer is light brown, silt loam about 4-14 inches thick. The subsoil is light yellowish brown, very gravelly or very cobbly clay loam or silty clay loam about 5-20 inches thick. The substratum, a brown, very gravelly silty clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The included similar soils are Mollic Cryoboralfs, fine loamy, mixed; Typic Cryoboralfs, loamy skeletal, mixed; and Typic Cryoboralfs, fine loamy, mixed.

The included moderately coarse textured dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed. The included poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 16-50 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited because of the harsh climate. Individual trees are often poorly formed, and may have spiral grain.

ROADS The unit is well suited to road construction. Unsurfaced roads may become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations.

RANGE The unit is poorly suited to range management. Location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. It is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good winter and fall moose, elk and grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat.

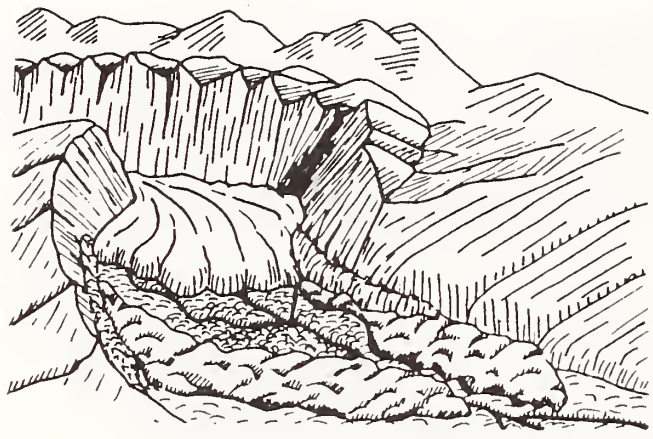
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-3B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations occur throughout the Gallatin Range.

M.U. COMPONENTS This unit contains medium to moderately fine textured soils with well expressed horizons. They are formed in glacial till deposits derived from volcanic rocks. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or steep glacial till deposits supporting subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,200-8,000	10

Hummocky, nearly level to rolling glacial till deposits are typical landforms. These deposits are located on the bottoms of U-shaped valleys. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These valleys are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Steep tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur throughout the unit. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twinflower (ABLA/LIBO) - 70 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI), subalpine fir/bluejoint (ABLA/CACA), subalpine fir-whitebark pine (ABLA-PIAL/VASC) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/LIBO occurs on northerly exposures. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. ABLA/ALSI and ABLA/CACA are on moist or wet soils in draws, along streams or near seeps and springs. They are more productive timber sites. ABLA-PIAL/VASC is at higher elevations where climate limits regeneration and timber productivity is lower.

EXISTING VEGETATION consists of dense lodgepole pine forest. The understory is composed of a thick mat of grouse whortleberry, blue huckleberry and twinflower.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from layered, volcanic rocks. These deposits are medium textured and contain variable amounts of rock fragments.

Included are some dissimilar moderately coarse textured more erodible glacial till deposits.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulation. Subsoils contain 35-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with somewhat dark colored surface layers. Included similar soils have fewer subsoil rock fragments or light colored surface layers. The included soils are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Small areas of dissimilar soils are included. Soils with moderately coarse textures occur where the glacial till is coarser textured. They occupy 10 percent of the unit and are not obviously associated with landscape features. They are more erodible. Also, included are poorly drained, fine textured soils in meadows and near seeps. They occupy 5 percent of the unit and have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a layer of partially decomposed forest litter less than 1 inch thick. The surface layer is light brown, silt loam about 4-14 inches thick. The subsoil is light yellowish brown, very gravelly or very cobbly clay loam or silty clay loam about 5-20 inches thick. The substratum, a brown, very gravelly silty clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The included similar soils are Mollic Cryoboralfs, fine loamy, mixed; Typic Cryoboralfs, loamy skeletal, mixed; and Typic Cryoboralfs, fine loamy, mixed.

The included moderately coarse textured dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed. The included poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53 to 71 cu. ft./acre. The unit is generally well suited to tractor operation. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation may be overcome by using vehicles only when the soil is dry or covered with snow.

ROADS The unit is well suited to road construction. Unsurfaced roads may become rutted when wet and dusty when dry. Surfacing or seasonal road closures help to overcome these limitations.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

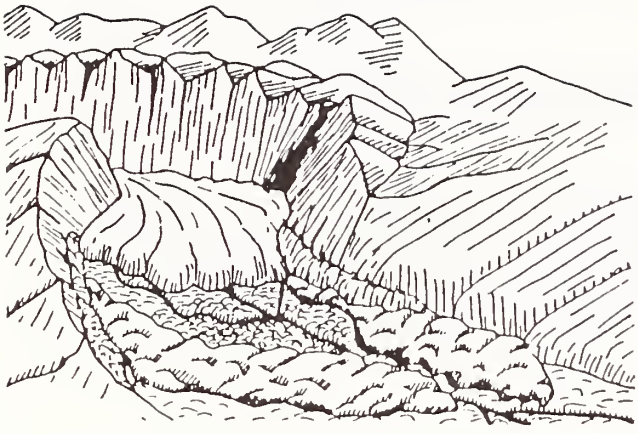
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-4B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations are mainly in the Absaroka-Beartooth Range, the northern Gallatin Range, and the Madison Range.

M.U. COMPONENTS The unit contains a complex of soils. Soils are medium to moderately fine textured with subsoil clay accumulations . They have formed in glacial till deposits derived from a mixture of rock types. Native vegetation is dense lower subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units are steep slopes with open grewn to dense forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,000-7,800	0

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping floodplains and terraces occur along larger streams. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with moderate channel gradients. Steep tributary streams cascade into these units from adjacent hanging valleys. Small lakes, ponds, and bogs occur occasionally throughout the unit. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twinflower (ABLA/LIBO) - 80 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA), subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC), and subalpine fir and spruce HTs associated with wet soils - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC, ABLA/VAGL and ABLA/LIBO HTs dominate the unit. ABLA/LIBO occurs on cool, moist exposures. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. FEID/AGCA occurs throughout the unit in mountain meadows. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site. The subalpine fir and spruce HTs associated with wet soils are adjacent to lakes, ponds, and bogs and are more productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered mountain meadows. The forest understory is composed of a thick mat of grouse whortleberry and blue huckleberry with some twinflower. The mountain meadows contain bearded wheatgrass, mountain brome and timber oatgrass.

GEOLOGY

OCCURRENCE The unit contains glacial till deposits - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from sandstone, shale and volcanic rocks. These deposits are medium to moderately fine textured.

Included is some dissimilar, coarser textured, more erodible glacial till derived from hard crystalline rocks.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 20-50 percent rounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils formed under dense forest vegetation have light colored surface layers and greater than 35 percent subsoil rock fragments. These soils occupy 55 percent of the unit. Soils formed under open canopied forests have somewhat darkened surface layers and greater than 35 percent subsoil rock fragments. Included similar soils have fewer subsoil rock fragments. These soils occupy 35 percent of the unit.

Small areas of dissimilar soils are included. Somewhat poorly drained soils occur near seeps and in depressions. These soils occupy 5 percent of the unit and have lower bearing strength. Also included are soils with dark colored surface layers. These soils are in meadows and occupy 10 percent of the unit.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown, gravelly loam surface layers about 11 inches thick. Subsoils are pale brown, very gravelly or very cobbly clay loam about 12 inches thick. The substratum, a very pale brown, very cobbly loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 4 for more detail.

The soils with somewhat dark colored surface layers have dark grayish brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown, very gravelly clay loam about 29 inches thick. The substratum, a brown, very gravelly sandy clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, loamy skeletal, mixed. The soils with somewhat dark colored surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed. The included dissimilar somewhat poorly drained soils are Aquic Cryoboralfs. The meadow soils are Argic Cryoborolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53-71 cu. ft./acre. The unit is generally well suited to tractor operation. Under certain moisture conditions, equipment operation may compact and rut the soil. Operating equipment only when the soil is dry or covered with snow can overcome this limitation.

ROADS The unit is well suited to road construction. Unsurfaced roads may become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The mountain meadows occupy 10 percent of the unit but produce over 90 percent of the useable forage. Location of forage in widely scattered areas limits accessibility. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The forest understory produces little useable forage. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall mule deer, elk and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Streams within the unit normally contain trout habitat. The unit also frequently borders streams containing suitable habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

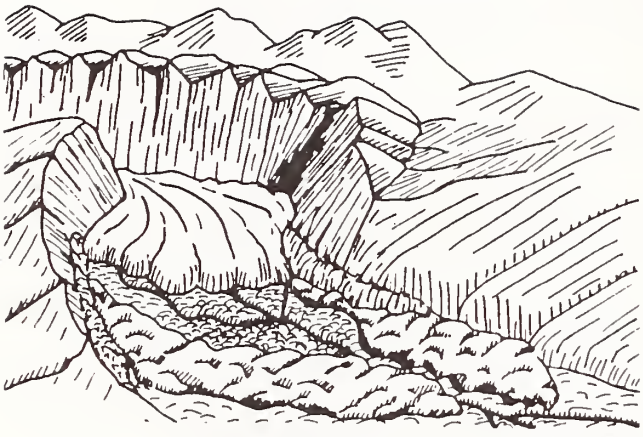
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 34-4C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, hummocky valley bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains, the Absaroka-Beartooth Range, and the southern Gallatin Range.

M.U. COMPONENTS The unit contains a complex of soils. Soils are moderately fine textured with subsoil clay accumulations. They are formed in glacial till deposits derived from mixed rock types. Native vegetation is mountain shrubland with some Douglas-fir forest.

ADJOINING M.U. Adjacent units are mountain grasslands or shrublands on steeper slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	6,800-7,800	0

The unit consists of hummocky, nearly level to rolling glacial till deposits. These deposits are located on the bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. These deposits are dissected by well defined intermittent streams. The drainage system has a dendritic or deranged pattern with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID)) - 75 percent. Included HTs with dissimilar management implications are Douglas-fir and subalpine fir HTs with shrub understory unions - 25 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID is the dominant HT. Idaho fescue/bluebunch wheatgrass (FEID/AGSP) is included as a similar HT. Warm, dry climates and moderate range site productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. Douglas-fir or subalpine fir series HTs occur on northerly or easterly exposures or in swales. Douglas fir/snowberry (PSME/SYAL) can occupy as much as 50 percent of delineations in the Mill Creek area of the Absaroka Mountains. These HTs are moderately productive timber sites.

EXISTING VEGETATION consists of mountain shrubland with scattered Douglas-fir or subalpine fir forest on northerly or easterly exposures or in swales. The shrublands have a moderately dense canopy of big sagebrush with an understory containing Idaho fescue and bluebunch wheatgrass. The forest understory contains ninebark, snowberry, and blue huckleberry. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from sandstone, shale and volcanic rocks. These deposits are medium to moderately fine textured and contain few rock fragments.

Included is some dissimilsr moderately coarse textured more erodible glacial till derived from hard crystalline rocks.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium and moderately fine textures and subsoil clay accumulations. Subsoils contain 0-35 percent rounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex pattern of soils. Soil properties vary with topographic position. Soils with moderately thick, dark colored surface layers occur on steep slopes and ridges. Included similar soils have fine textured subsoils. These soils occupy 40 percent of the unit.

Soils with very thick, dark colored surface layers are in depressions and on toe slopes and benches. Included are similar soils have fine textured subsoils. These soils occupy 40 percent of the unit.

Included are up to 20 percent dissimilar soils. Soils with light colored surface layers, some of which have more than 35 percent subsoil rock fragments, occur under forest vegetation. They are timber sites.

GENERAL DESCRIPTION The soils with moderately thick, dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are pale brown, clay loam about 15 inches thick. The substratum, a light yellowish brown, clay loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

The soils with very thick, dark colored surface layers have loam surface layers about 12 inches thick. Subsoils are brown, clay loam or gravelly clay loam about 14 inches. The substratum, a pale brown, gravelly clay loam, overlies bedrock at depths greater than 5 feet. See soil description 18 for more detail.

CLASSIFICATION REMARKS The soils with moderately thick, dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Cryoborolls, fine, mixed. The soils with very thick, dark surface layers are Argic Pachic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Pachic Cryoborolls, fine, mixed.

The included dissimilar forest soils with light colored surface layers are Typic Cryoboralfs, fine, loamy, mixed and Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management. Delineations in the Mill Creek area (Absarokas) contain more timber and are better suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help to overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,820 pounds per acre of air dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Forage production increases following timber harvest and the unit is well suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good year long mule deer habitat for mule It is potentially good fall elk habitat. Some delineations provide potentially good elk winter habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

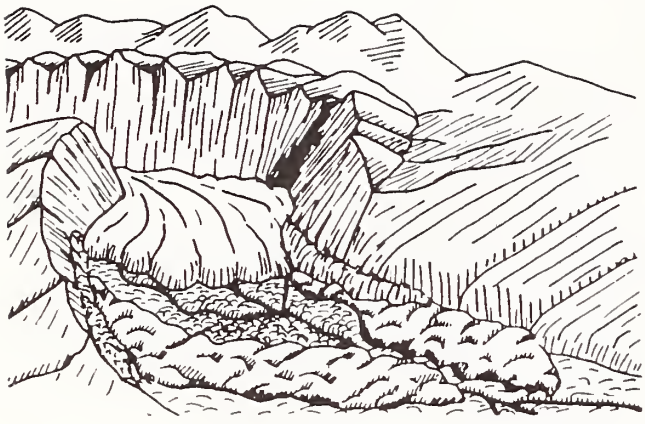
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	low
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	less than 26
Spring Runoff	March-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the central Crazy Mountains, the southern Absaroka-Beartooth Range, and north of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured. They are formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is variably dense upper subalpine forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or glacial till deposits supporting dense subalpine forests.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,800-8,500	15

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with steep channel gradients. Tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur in less sloping areas. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 75 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), or subalpine fir/heartleaf arnica (ABLA/ARCO) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs throughout. Whitebark pine-subalpine fir (PIAL-ABLA) is included at higher elevations as a similar HT. Cold climates and low timber productivity are associated with these HTs.

Included are up to 10 percent dissimilar HTs. ABLA/VASC and ABLA/VAGL occur at lower elevations and are more productive timber sites. ABLA/ARCO is intermixed with the major HT and is also a more productive timber site.

EXISTING VEGETATION consists of open grown to dense stunted whitebark pine, subalpine fir, and Engelmann spruce forest. Some dense lodgepole pine forest is included at lower elevations. The forest understory is composed of moderately sparse mats of grouse whortleberry or heartleaf arnica.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. These deposits are moderately coarse textured and contain many rock fragments. The till substratum is highly erodible.

Included is some dissimilar, finer textured, less erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, moderately acid and moderately coarse to medium textured. Subsoils contain more than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex pattern of soils and rock outcrop. Rock outcrop occurs throughout as subdued, rounded knobs and occupies 15 percent of the unit. The soils are weakly developed with light colored surface layers. Included similar soils have slight subsoil accumulations of clay, slightly fewer subsoil rock fragments, dark colored surface layers, or less acid subsoils. The soils with slightly fewer subsoil rock fragments or subsoil clay accumulations are not obviously associated with landscape features. The soils with darker surface layers occur near seeps and depressions. The soils with less acid subsoils are at lower elevations. These soils occupy 70 percent of the unit.

Included are small areas of dissimilar soils. Soils with moderately fine textured subsoils are in areas underlain by micaceous shist and occupy 10 percent of the unit. They are on more productive timber sites and are less erodible. Included also are poorly drained soils near seeps. They have lower bearing strength, and occupy 5 percent of the unit.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is light brownish gray, very gravelly loam about 4 inches thick. The subsoil is pale brown, very cobbly sandy loam about 14 inches thick. The substratum, a very pale brown, very cobbly or very bouldery sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 24 for more detail.

CLASSIFICATION REMARKS The major soils are Dystric Cryochrepts, loamy skeletal, mixed. The included similar soils are Typic Cryoboralfs, loamy skeletal, mixed; Dystric Cryochrepts, coarse loamy, mixed; Typic Cryumbrepts, loamy skeletal, mixed; and Typic Cryochrepts, loamy skeletal, mixed. The Typic Cryoboralfs have very slight clay accumulations in the subsoil.

The included dissimilar soils with moderately fine textured subsoils are Mollic Cryoboralfs, loamy skeletal, mixed. The included poorly drained soils are Argic Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-32 cu. ft./acre. Regeneration is moderately limited because of harsh subalpine climates. Individual trees are often poorly formed and may have spiral grain.

ROADS The unit is moderately suited to road construction. Non-rippble bedrock moderately limits excavation. The material exposed by road construction is moderately erodible and tends to unravel on steep cutbanks. Revegetation of cut and fill slopes and annual maintenance of the drainage system helps control erosion. Low fertility and harsh climates limit establishment and recovery of vegetation. Special revegetation practices may be required. Avalanches are a hazard to winter road use.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. These forest sites are poorly suited for transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially fair habitat within summer and fall elk, moose, bighorn sheep, and grizzly bear range. It provides good security cover when stands are pole or sapling size. Only major streams within the unit normally contain trout habitat.

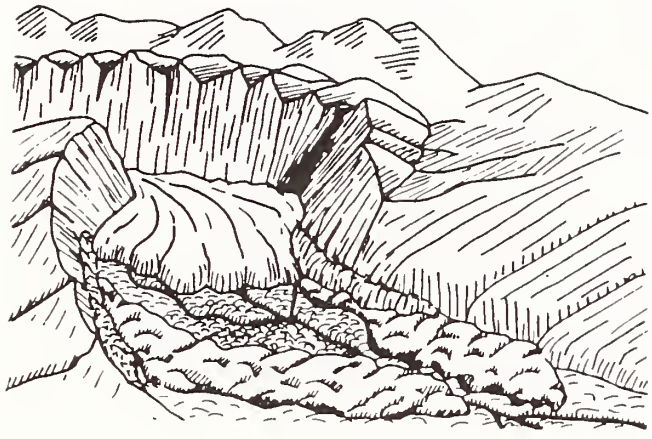
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	under 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains and the Absaroka-Beartooth Range and around Hebgen Lake.

M.U. COMPONENTS The unit contains an association of soils. Soils are moderately coarse to medium textured with subsoil clay accumulations. They are formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is mountain shrubland with some sparse Douglas fir forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or glacial till deposits with variably dense Douglas-fir forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,500-7,500	5

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined intermittent streams. The drainage system has a dendritic or deranged pattern with steep channel gradients. These landforms have high subsurface water holding capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of low sagebrush/Idaho fescue (ARAR/FEID) - 90 percent. An included HT with dissimilar management implications are Douglas-fir/snowberry (PSME/SYAL) - 5 percent.

HABITAT TYPE DISTRIBUTION ARAR/FEID is the dominant HT. Included as similar HTs are Douglas-fir and limber pine HTs with bunchgrass understories. Warm, dry climates and low range site productivity are associated with these HTs in this unit.

Up to 5 percent dissimilar HTs are included. PSME/SYAL occurs as dense forests on northern exposures along the margins of the unit. It is a timber site.

EXISTING VEGETATION consists of mountain shrubland with a few scattered, sparse stands of Douglas-fir and limber pine. The shrublands have a variably dense canopy of low sagebrush with a bunchgrass understory containing bluebunch wheatgrass and Idaho fescue. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. These deposits are moderately coarse textured and contain many rock fragments. The till substratum is moderately erodible.

Included is some dissimilar, finer textured, less erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, moderately acid and moderately coarse to medium textured with subsoil clay accumulations. Subsoils contain more than 35 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with landscape position and texture of the glacial till deposits. Soils formed on mounds and ridges have dark colored surface layers. These soils occupy 60 percent of the unit. Soils in swales and depressions have very thick, dark colored surface layers. They occupy 20 percent of the unit. Delineations in the Hebgen Lake area and the Crazy Mountains have finer textured soils.

Included are up to 15 percent dissimilar soils. These soils lack subsoil clay accumulation and have coarser textures. They have lower range producivity and are more erodible.

GENERAL DESCRIPTION Soils with dark colored surface layers have brown, gravelly loam surface layers about 7 inches thick. Subsoils are brown, gravelly sandy clay loam about 12 inches thick. The substratum, a light yellowish brown, very cobbly or very gravelly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

The soils with very thick dark colored surface layers have brown, gravelly loam surface layers about 18 inches thick. Subsoils are brown, very cobbly or very bouldery sandy clay loam about 13 inches thick. The substratum, a light brown, very cobbly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 19 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed. Soils with very thick dark colored surface layers are Argic Pachic Cryoborolls, loamy skeletal, mixed.

The included dissimilar coarser textured soils are Typic Cryoborolls, loamy skeletal, mixed and Pachic Cryoborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered stands of trees and is poorly suited to timber management.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and tends to unravel on steep cutslopes. Revegetating cut and fill slopes and annual maintenance of the drainage system helps control erosion. Low fertility limits establishment and recovery of vegetation and special revegetation practices may be required.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 800 pounds per acre of air dry herbage in normal years. Soils in swales and depressions have higher productivity. Slope steepness and lack of stock water moderately limit forage accessibility. Livestock tend to concentrate in less sloping areas. Drift fences, herding, and salting away from water help overcome this limitation.

WILDLIFE-FISHERIES This unit is potentially good winter mule deer, elk, and bighorn sheep, spring grizzly bear and summer and fall mule deer habitat. It is potentially good spring and summer blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

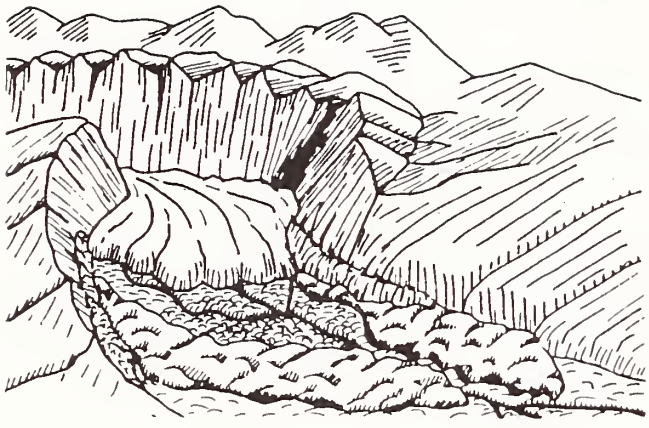
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	low

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains, the Asbaroka-Beartooth Range, and Madison Range.

M.U. COMPONENTS Soils are moderately coarse to medium textured. They are formed in glacial till deposits derived from hard crystalline rocks. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or are glacial till deposits supporting dense to sparse subalpine or Douglas-fir forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,800-7,800	10

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded, subdued bedrock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with steep channel gradients. Tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur in less sloping areas. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twinflower (ABLA/LIBO) - 70 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI), subalpine fir/bluejoint (ABLA/CACA), subalpine fir-whitebark pine (ABLA-PIAL/VASC) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/LIBO is on northern exposures. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. ABLA/ALSI and ABLA/CACA occur in draws, along streams, or near seeps. They are more productive timber sites. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of a thick mat of grouse whortleberry, blue huckleberry, and twinflower.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from hard crystalline rocks. These deposits are moderately coarse textured and contain many rock fragments. The till substratum is moderately erodible.

Included is some dissimilar, finer textured, less erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately coarse and medium textures. Subsoils contain 25-60 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains slightly acid soils with light colored surface layers and more than 35 percent subsoil rock fragments. Included are similar soils with fewer subsoil rock fragments, or moderately acid subsoils. These soils occupy 85 percent of the unit.

Included are up to 5 percent dissimilar soils. Soils with finer textured subsoils occur in areas with finer textured till. They are less erodible and more productive timber sites. Included also are somewhat poorly drained soils in depressions or near seeps and springs. They have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter less than one inch thick. The surface layer is light brown, very gravelly loam 3 inches thick. The subsoil is very pale brown, very cobbly sandy loam about 29 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 21 for more detail.

The included dissimilar soils with moderately fine textured subsoils are Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, loamy skeletal, mixed. The somewhat poorly drained soils are Arqiaquic Cryoborolls and Aquic Cryoboralfs.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 33-63 cu. ft./acre. Slope steepness moderately limits equipment operation. Cable yarding systems help overcome this limitation. Regeneration is moderately limited by moisture stress and low soil fertility. Design of cutting units to prolong snow melt and creating shade with slash can help overcome the moisture stress limitation. Rock fragments on the surface and in the subsoil make planting difficult.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on steep cutslopes and is moderately erodible. Revegetating cut and fill slopes and annual maintenance of the drainage system help control erosion. Low fertility limits establishment of vegetation and special revegetation practices can be required.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. These forested sites are poorly suited for use as transitory forage following timber harvest.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall elk and moose habitat. Only major streams within the unit normally contain trout habitat.

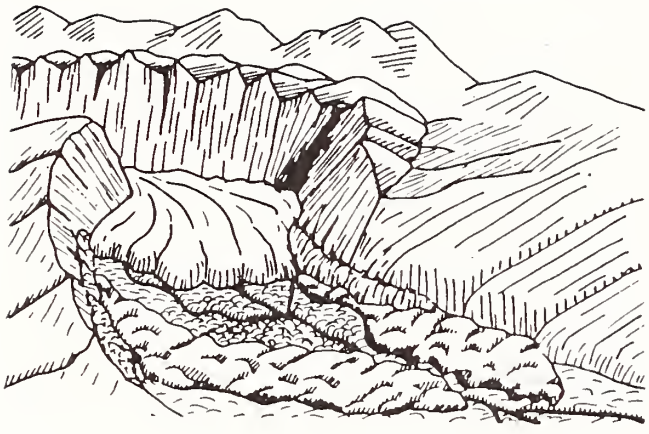
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low to moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the Bridger Range, the Absaroka-Beartooth Range and the southern Madison Range.

M.U. COMPONENTS This unit contains an association of soils. Soils are medium to moderately fine textured with subsoil clay accumulations. They are formed in glacial till derived from sandstone and shale. Native vegetation is dense lower subalpine forest and mountain meadows.

ADJOINING M.U. Adjacent units have steep, rocky slopes or glacial till deposits with variably dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,800-7,800	5

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded subdued bedrock outcrops are common. These deposits are dissected by well defined, perennial streams. The drainage system has a trellis or deranged pattern with steep channel gradients. Small lakes, ponds, and bogs occur in less sloping areas. These landforms have a moderate landslide hazard. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of a complex of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/grouse whortleberry (ABLA/VASC) - 55 percent; and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 20 percent. Included HTs with dissimilar management implications are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC), and subalpine fir/alder (ABLA/ALSI) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the forested areas. Subalpine fir/heartleaf arnica (ABLA/ARCO), subalpine fir/pinegrass (ABLA/CARU) and subalpine fir/virgins bower (ABLA/CLPS) are included as similar HTs. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit. FEID/AGCA occurs in meadows. Moderately productive range sites are associated with this HT in this unit.

Included are up to 20 percent dissimilar HTs. ABLA/ALSI occurs on moist sites in depressions or around seeps. It is a more productive timber site. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered mountain meadows. The forest understory is a thick mat of grouse whortleberry and blue huckleberry. The mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass and common forbs.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from limestone, sandstone, and shale. These deposits are medium to moderately fine textured and contain variable amounts of rock fragments.

Included is some dissimilar, moderately coarse textured, more erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 20-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils under forest have somewhat light colored surface layers and less than 35 percent subsoil rock fragments. Included similar soils have light colored surface layers or more subsoil rock fragments. These soils occupy 50 percent of the unit. Soils in meadows have dark colored surface layers and contain few rock fragments. Included similar soils have very thick, dark surface layers. They are in swales and some depressions. These soils occupy 35 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with moderately coarse textures occur in areas with coarser textured glacial till. theThey are more erodible. Also included are poorly drained, fine textured soils in wet meadows or near seeps. They have lower bearing strength.

GENERAL DESCRIPTION The soils with somewhat light colored surface layers have light brownish gray, loam surface layers about 14 inches thick. Subsoils are light yellowish brown, gravelly clay loam about 22 inches thick. The substratum, a brown sandy clay loam, overlies bedrock at depths greater than 5 feet. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are pale brown clay loam about 15 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with somewhat light colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed and Mollic Cryoboralfs, loamy skeletal, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Pachic Cryoborolls, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed. The included poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 57-67 cu. ft./acre. Slope steepness moderately limits equipment operation. Cable yarding systems help overcome this limitation. Regeneration is slightly limited by understory competition. This limitation is greatest near meadows. Site preparation can reduce competition. The forest helps stabilize unstable slopes. Timber harvest may increase the risk of landslides.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill slope sloughing. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations. Unstable slopes occur in this unit. Slope stability should be evaluated before planning and locating roads.

RANGE The unit is moderately suited to range management. The included meadow occupy less than $\bar{e}$ percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. The potential meadow plant community produces about 2,225 pounds per acre of air dry herbage in normal years. The forested areas produce little forage. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range. Slope steepness moderately limits accessibility of forage. The soil in mountain meadows has low bearing strength when wet. Delaying grazing until the soil has dried helps prevent trampling damage to soil and vegetation.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose, and grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit it is a potential source of sediment which can damage fish habitat.

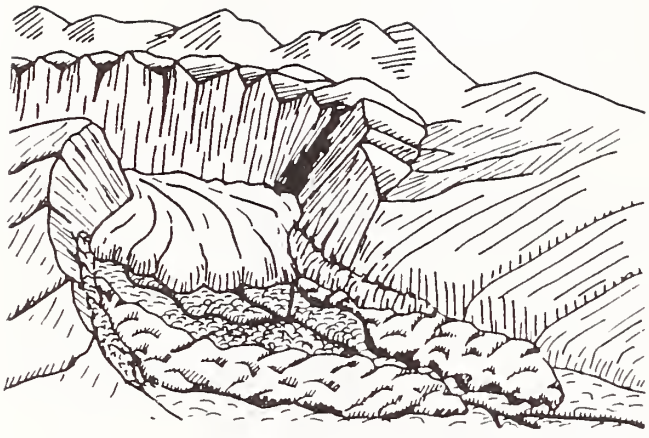
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	35-50
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the Gallatin Range and the central Madison Range.

M.U. COMPONENTS This unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured with subsoil clay accumulations. They are formed in glacial till deposits derived from volcanic rocks. Native vegetation is open grown to dense upper subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have steep, rocky slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,800-8,500	15

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded subdued bedrock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with steep channel gradients. Tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur in less sloping areas. These landforms have a moderate landslide hazard. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 60 percent, and Idaho fescue/tufted hairgrass (FEID/DECA) - 15 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), or subalpine fir/heartleaf arnica (ABLA/ARCO) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs in forested areas. Whitebark pine - subalpine fir (PIAL-ABLA) is a similar included HT. Cold climates and low timber productivity are associated with this HT in this unit. FEID/DECA occurs in moist meadows. High range site productivity is associated with this HT in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/VAGL and ABLA/VASC occur at lower elevations. ABLA/ARCO is scattered through the ABLA-PIAL/VASC. These HTs are more productive timber sites.

EXISTING VEGETATION consists of an open grown to dense forest of stunted whitebark pine, subalpine fir and Engelmann spruce. The forest understory is a mat of grouse whortleberry and heartleaf arnica. Mountain meadows containing tufted hairgrass, Idaho fescue and sedges are scattered throughout the forest.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from layered, volcanic rocks. These deposits are medium textured and contain variable amounts of rock fragments.

Included is some dissimilar, coarser textured, more erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 20-50 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils under forest have somewhat light colored surface layers and less than 35 percent subsoil rock fragments. Included similar soils have light colored surface layers or more subsoil rock fragments. These soils occupy 50 percent of the unit. Soils in meadows have dark colored surface layers and contain few rock fragments. Included similar soils have very thick, dark surface layers. They are in swales and some depressions. These soils occupy 35 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with moderately coarse textures occur in areas with coarser textured glacial till. theThey are more erodible. Also included are poorly drained, fine textured soils in wet meadows or near seeps. They have lower bearing strength.

GENERAL DESCRIPTION The soils with somewhat light colored surface layers have light brownish gray, loam surface layers about 14 inches thick. Subsoils are light yellowish brown, gravelly clay loam about 22 inches thick. The substratum, a brown sandy clay loam, overlies bedrock at depths greater than 5 feet. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are pale brown clay loam about 15 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with somewhat light colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed and Mollic Cryoboralfs, loamy skeletal, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Pachic Cryoborolls, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed. The included poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 57-67 cu. ft./acre. Slope steepness moderately limits equipment operation. Cable yarding systems help overcome this limitation. Regeneration is slightly limited by understory competition. This limitation is greatest near meadows. Site preparation can reduce competition. The forest helps stabilize unstable slopes. Timber harvest may increase the risk of landslides.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill slope sloughing. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations. Unstable slopes occur in this unit. Slope stability should be evaluated before planning and locating roads.

RANGE The unit is moderately suited to range management. The included meadow occupy less than $\bar{e}$ percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. The potential meadow plant community produces about 2,225 pounds per acre of air dry herbage in normal years. The forested areas produce little forage. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range. Slope steepness moderately limits accessibility of forage. The soil in mountain meadows has low bearing strength when wet. Delaying grazing until the soil has dried helps prevent trampling damage to soil and vegetation.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose, and grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit it is a potential source of sediment which can damage fish habitat.

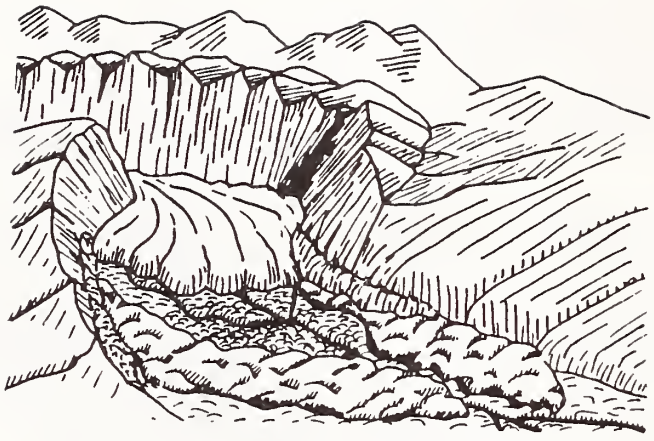
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	35-50
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-3B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the western Absaroka-Beartooth Range and the Gallatin Range.

M.U. COMPONENTS This unit contains medium to moderately fine textured soils with subsoil clay accumulations. They are formed in glacial till deposits derived from volcanic rocks. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes or steep glacial till deposits supporting upper subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,200-8,000	10

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleysand basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded subdued bedrock outcrops are common. These deposits are dissected by well defined, large perennial streams. The drainage system has a trellis pattern with steep channel gradients. Tributary streams cascade into these valleys from adjacent hanging valleys. Small lakes, ponds, and bogs occur throughout the unit. These landforms have a moderate landslide hazard. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twinflower (ABLA/LIBO) - 70 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI), subalpine fir/bluejoint (ABLA/CACA), subalpine fir-whitebark pine (ABLA-PIAL/VASC) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/LIBO is on northerly exposures. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. ABLA/ALSI and ABLA/CACA occur along streams or near bogs and seeps. They are more productive timber sites. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of a thick mat of grouse whortleberry, blue huckleberry, and twinflower.

GEOLOGY

OCCURRENCE The unit consists of glacial till - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from layered, volcanic rocks. These deposits are medium textured and contain variable amounts of rock fragments.

Included is some dissimilar, coarser textured, more erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 10-40 percent subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with somewhat darkened surface layers and greater than 35 percent subsoil rock fragments. Included as similar are soils with fewer subsoil rock fragments and soils with light colored surface layers. The included soils are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Included are up to 15 percent dissimilar soils. Soils with moderately coarse textures occur where the glacial till is coarser textured. They are more erodible. Also, included are poorly drained, fine textured soils in meadows and near seeps. They have lower bearing strength.

GENERAL DESCRIPTION The soil surface is covered with a layer of partially decomposed forest litter less than 1 inch thick. The surface layer is light brown, silt loam 4-14 inches thick. The subsoil is light yellowish brown, very gravelly or very cobbly clay loam or silty clay loam about 5-20 inches thick. The substratum, a brown, very gravelly silty clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The included similar soils are Mollic Cryoboralfs, fine loamy, mixed; Typic Cryoboralfs, loamy skeletal, mixed; and Typic Cryoboralfs, fine loamy, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed. The included poorly drained soils are Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 49-81 cu. ft./acre. Slope steepness moderately limits equipment operation. Cable yarding systems help overcome this limitation. Under certain moisture conditions, equipment operation may rut and compact the soil. Operating equipment only when the soil is dry or snow covered can overcome this limitations.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations. Unstable slopes occur in this unit. Slope stability should be evaluated before planning and locating roads.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Forage production increases following timber harvest, and the unit is moderately suited for use as transitory range. Slope steepness moderately limits forage accessibility.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

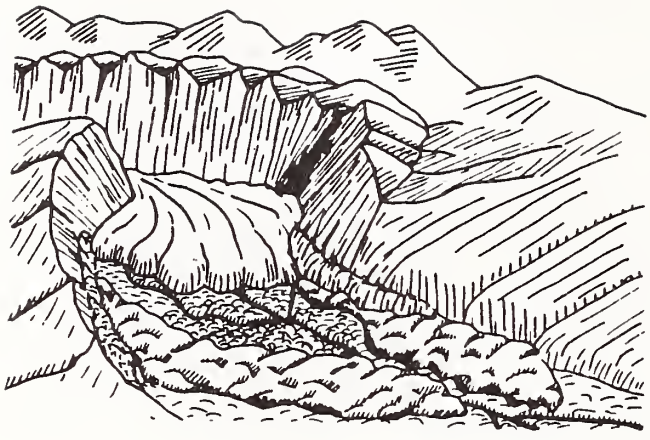
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 35-4C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep hummocky valley sides and bottoms (center of block diagram). Delineations are mainly in the Crazy Mountains, the Absaroka-Beartooth Range, and the southern Gallatin Range.

M.U. COMPONENTS The unit contains a complex of soils. Soils are moderately fine textured with subsoil clay accumulations. They are formed in glacial till deposits derived from mixed rock types. Native vegetation is mountain shrublands with some Douglas-fir forest.

ADJOINING M.U. Adjacent units have forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,800-7,800	10

The unit consists of hummocky, steep glacial till deposits. These deposits are located on the lower sides and bottoms of U-shaped valleys and basins. Alluvial fans occur where tributary streams enter these valleys. At lower elevations, gently sloping flood plains and terraces occur along larger streams. Rounded subdued bedrock outcrops are common. These deposits are dissected by well defined intermittent streams. The drainage system has a dendritic or deranged pattern with steep channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID) - 70 percent. Included HTs with dissimilar management implications are Douglas fir/snowberry (PSME/SYAL) and subalpine fir/blue huckleberry (ABLA/VAGL) - 20 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID occurs throughout the unit. Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and Douglas-fir HTs with bunchgrass understory unions are included as similar HTs. Warm climates and moderate range site productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. PSME/SYAL and ABLA/VAGL occur in densely forest areas on northerly or easterly aspects. They are timber sites. Dense Douglas fir can occupy up to 50 percent of delineations in the Mill Creek area (Absarokas).

EXISTING VEGETATION consists of sparce to dense stands of big sagebrush with an understory dominated by Idaho fescue and bluebunch wheatgrass. Douglas-fir forest is in swales and on northerly or easterly exposures. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit consists of glacial till deposits - 100 percent.

The glacial till deposits are Pleistocene in age and derived primarily from sandstone and shale, with some volcanic rocks. These deposits are medium to moderately fine textured and contain few rock fragments.

Included is some dissimilar, coarser textured, more erodible glacial till.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures and subsoil clay accumulations. Subsoils contain 0-25 percent rounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex pattern of soils. Soil properties vary with topographic position. Soils with moderately thick, dark colored surface layers are on steeper slopes and ridges. They occupy 30 percent of the unit. Soils with very thick, dark colored surface layers occur in depressions and on toe slopes and benches. They occupy 40 percent of the unit. Finer textured soils are included as similar in all topographic positions.

Small areas of dissimilar soils are included. Soils with light colored surface layers occur under dense forest and occupy 20 percent of the unit.

GENERAL DESCRIPTION The soils with moderately thick, dark surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are pale brown, clay loam about 15 inches thick. The substratum, a light yellowish brown, clay loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

The soils with very thick, dark colored surface layers have grayish brown, loam surface layers about 20 inches thick. Subsoils are brown, clay loam about 18 inches thick. The substratum, a pale brown clay loam, overlies bedrock at depths greater than 5 feet. See soil description 18 for more detail.

CLASSIFICATION REMARKS The soils with moderately thick dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included as similar are Argic Cryoborolls, fine, mixed. The soils with very thick, dark colored surface layers are Argic Pachic Cryoborolls, fine loamy, mixed. Included as similar are Argic Pachic Cryoborolls, fine, mixed.

The included dissimilar soils with light colored surface layers are Typic Cryoboralfs, fine, loamy, mixed and Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management. Delineations in the Mill Creek area (Absarokas) contain more forest and are better suited to timber management.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 1,820 pounds per acre of air dry herbage in normal years. Slope steepness and lack of water moderately limit accessibility of forage. Drift fences, herding, and salting away from water help overcome this limitation. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The included densely forested areas produce some forage, and are moderately suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good fall and winter elk and year long mule deer habitat. It is potentially fair spring and summer blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

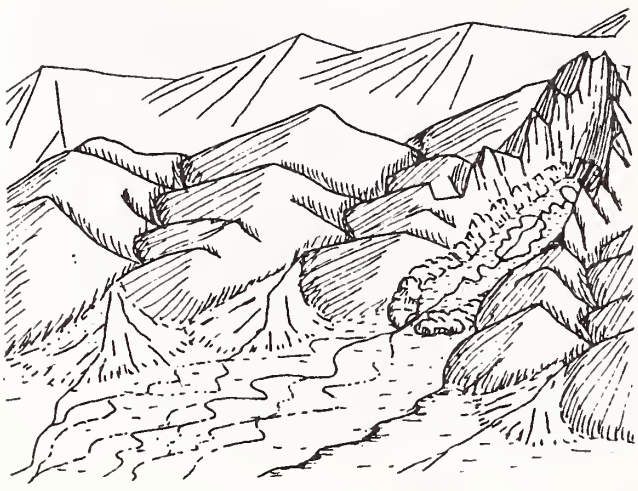
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	low
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	less than 26
Spring Runoff	March-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 46-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level plains and benches (lower part of block diagram). Delineations are adjacent to major streams and rivers.

M.U. COMPONENTS The unit contains an undifferentiated group of soils. Soils are moderately coarse to medium textured. They have formed in glacial outwash deposits derived primarily from hard crystalline rocks. Native vegetation is mountain shrublands, with some open grown Douglas-fir forest.

ADJOINING M.U. Adjacent units have steeper slopes or forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Variable	5,200-6,400	0

The unit consists of nearly level terraces in large valley bottoms. These terraces are frequently adjacent to major streams and rivers. Larger terraces may contain old, braided stream courses. These terraces are dissected by poorly defined intermittent streams. The drainage system has an irregular pattern with low channel gradients. These landforms are stable except on terrace escarpments where soils tend to unravel. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/bluebunch wheatgrass (ARTR/AGSP) - 75 percent. Included HTs with dissimilar management implications are big sagebrush/Idaho fescue (ARTR/FEID) - 15 percent and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 10 percent.

HABITAT TYPE DISTRIBUTION ARTR/AGSP dominates the unit. Included as similar HTs are Douglas-fir (PSME) and limber pine (PIFL) HTs with bunchgrass understory unions. Warm, dry climates and low to moderate range productivity are associated with these HTs in this unit.

The included dissimilar HTs FEID/AGSP and ARTR/FEID occur on abandoned stream courses at higher elevations. They are more productive range sites.

EXISTING VEGETATION consists of sparce to dense canopies of big sagebrush with grassy understories. The height of the sagebrush varies from 15-24 inches and seldom exceeds 30 inches. The understory is dominated by bluebunch wheatgrass, junegrass, and green needlegrass. Forbes are generally absent. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit contains glacial outwash and alluvial deposits - 100 percent.

The glacial outwash and alluvial deposits are derived primarily from hard crystalline rocks. These deposits are Pleistocene or Holocene in age. Loamy soils containing rounded boulders, cobbles, and pebbles are associated with these deposits.

Included are some finer textured deposits with dissimilar properties. These deposits are adjacent to low gradient streams. The soils formed in these deposits are more productive and have lower bearing strength.

SOILS

GENERAL NATURE OF SOILS Soils are well to somewhat excessively drained, with moderately coarse and medium textures. Subsoils contain 35-65 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an undifferentiated group of soils. Soil properties vary with average annual precipitation. Soils with dark colored surface layers occur where average annual precipitation exceeds 10 inches. Soils with lighter colored surface layers occur where average annual precipitation is approximately 10 inches. These more arid regions are in the eastern and southeastern parts of the survey area. Included as similar are soils with light colored subsurface layers or that have subsoils containing less than 35 percent rock fragments.

Small areas of dissimilar soils are included. Thicker soils occur in swales, along old drainageways, or in recent alluvial deposits and occupy 15 percent of the unit. They are more productive range sites. Soils with weakly expressed horizons are on benches with gravelly surfaces. They are less productive range sites.

GENERAL DESCRIPTION The surface layer is a very dark grayish brown to grayish brown sandy loam or loam about 8 inches thick. The upper subsoil is light yellowish brown, very gravelly loam about 6 inches thick. The lower subsoil, is light yellowish brown, very cobbly sandy loam or loam about 8 inches thick. The substratum, a yellowish brown, very cobbly loam or sandy loam, overlies bedrock at depths greater than 5 feet. See soil descriptions 9 and 12 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Typic Argiborolls, loamy skeletal, mixed. The soils with lighter colored surface layers are Aridic Argiborolls, loamy skeletal, mixed. The included similar soils with light colored subsurface layers are Boralfic Argiborolls, loamy skeletal, mixed. The soils with subsoils containing less than 35 percent rock fragments are Typic Argiborolls, fine loamy, mixed and Aridic Argiborolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Subsoil material exposed by road construction is stony and rough on road surfaces. Soil surface layers are slick when wet on road surfaces. Surfacing overcomes these limitations.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 700-1,500 pounds per acre of air dry herbage in normal years. Productivity is highest in the western half of the survey area where average annual precipitation is highest. In places, sagebrush control improves production of desirable forage plants and accessibility of forage. Lack of stock water limits the distribution of livestock.

WILDLIFE-FISHERIES The unit is potentially good winter mule deer and elk habitat. It is potentially fair winter bighorn sheep habitat, and good spring blue grouse habitat. It can provide spring grizzly bear habitat in the east half of the survey area. Only major streams within the unit normally contain trout habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

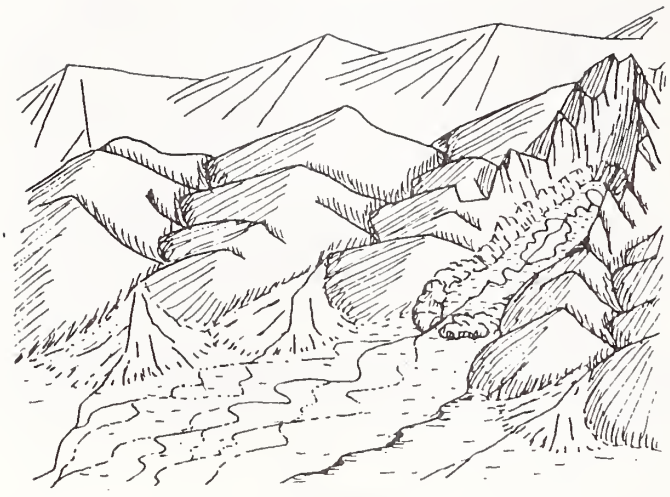
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	medium

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	10-20
Precipitation Distribution	40% snow; 60% rain
Average Winter Snow Depth (inches)	under 25
Spring Runoff	March-April
Length of Frost Free Season (days)	over 120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 46-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level plains dnd benches (lower part of block diagram). Delineations are adjacent to major streams and rivers in the survey area.

M.U. COMPONENTS The unit contains medium to moderately fine textured soils. They are formed in glacial outwash deposits derived primarily from sedimentary or volcanic rocks. Native vegetation is mountain grasslands and shrublands with some Douglas-fir forest.

ADJOINING M.U. Adjacent units have steeper slopes or forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Variable	6,500-7,500	0

The unit consists of nearly level terraces in large valley bottoms. These terraces are frequently adjacent to major streams and rivers. Larger terraces may contain old, braided stream courses. These terraces are dissected by poorly defined intermittent streams. The drainage system has an irregular pattern with low channel gradients. These landforms are stable except on terrace escarpments where soils tend to unravel. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 40 percent and big sagebrush/Idaho fescue (ARTR/FEID) - 35 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and Douglas-fir (PSME) and subalpine fir (ABLA) HTs with low shrub understories - 25 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID form a mosaic throughout the unit. Douglas-fir and limber pine HTs with bunchgrass understory unions are included similar HTs. Warm, dry climates and moderate range site productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. Douglas-fir and subalpine fir HTs with shrub understory unions occur in densely forested areas. They are timber sites. FEID/AGCA occurs on moist sites near seeps or in swales and is a more productive range site.

EXISTING VEGETATION consists of a mosaic of mountain shrubland and mountain grassland with scattered Douglas-fir or limber pine forest. The mountain grasslands contain Idaho fescue, bluebunch wheatgrass, junegrass, and western needlegrass. The mountain shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue. In forested areas, the understory is dominated by bunchgrasses where the forest is open grown and shrubs where the canopy is dense. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit contains glacial outwash and alluvial deposits - 100 percent.

The glacial outwash and alluvial deposits are derived primarily from sandstone, limestone, and shale. They are Pleistocene or Holocene in age. Soils formed in these deposits are medium to moderately fine textured and contain rounded cobbles and pebbles.

Included are dissimilar deposits containing fewer rock fragments. They have lower bearing strength.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and moderately fine textured. Subsoils contain more than 35 percent rounded and subrounded rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of an undifferentiated group of soils. Soil properties vary with average annual precipitation and the quantity of subsoil rock fragments. Soils with dark colored surface layers occur where average annual precipitation exceeds 20 inches. Soils with lighter colored surface layers occur where average annual precipitation is less than 20 inches or where soils overlie limestone rubble. Included are similar soils with fewer subsoil rock fragments. These soils occupy 75 percent of the unit.

Included are up to 25 percent dissimilar soils. Somewhat poorly drained soils,or soils with thick dark surface layers occur in swales or near seeps and occupy. They are more productive range sites. Soils with light colored surface layers occur under dense forests. They are timber sites.

GENERAL DESCRIPTION The surface layer is dark grayish brown, silt loam about 8 inches thick. The upper subsoil is light yellowish brown, very gravelly silt loam about 6 inches thick. The lower subsoil is light yellowish brown, very cobbly silty clay loam about 8 inches thick. The substratum, a yellowish brown, very cobbly loam, overlies bedrock at depths greater than 5 feet. See soil description 10 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Argiborolls, loamy skeletal, mixed. The included similar soils with lighter colored surface layers are Aridic Argiborolls, loamy skeletal, mixed. The soils with subsoils containing less than 35 percent rock fragments are Typic Argiborolls, fine loamy mixed.

Included are up to 25 percent dissimilar soils. The somewhat poorly drained soils are Aquic Argiborolls, fine loamy, mixed. Soils under dense forests are Mollic Eutroboralfs, loamy skeletal, mixed, or Typic Ustochrepts, loamy skeletal, mixed frigid.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,408 pounds per acre of air dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. In places, sagebrush control improves production of desirable forage plants and forage accessibility. Lack of stock water may limit the distribution of livestock.

WILDLIFE-FISHERIES This unit is potentially good fall elk, summer mule deer and spring grizzly bear habitat. At lower elevations, it is potential elk winter range. Good spring blue grouse habitat is also available. Only major streams within the unit normally contain trout habitat. If erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

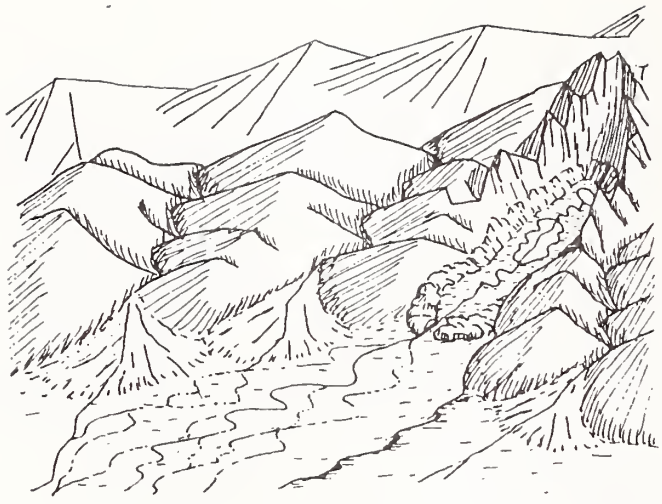
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	low to moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	15-30
Precipitation Distribution	40% snow; 60% rain
Average Winter Snow Depth (inches)	26-40
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 46-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level plains and benches (lower part of block diagram). Delineations are mainly in the Hebgen Lake Area.

M.U. COMPONENTS This unit contains coarse textured soils. They are formed in glacial outwash deposits derived from obsidian and rhyolite. Native vegetation is moderately dense lodgepole pine forest.

ADJOINING M.U. Adjacent units have steeper slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Variable	6,600-7,000	0

Nearly level plains terraces in large valley bottoms are typical landforms. These terraces are underlain by rounded gravels and cobbles of glacial or alluvial origin. These surfaces are frequently perched above streams and rivers. Larger terraces may contain dry, braided stream courses. These terraces are dissected by poorly defined intermittent streams. The drainage system has an irregular pattern with low channel gradients. These landforms are stable except on terrace escarpments where soils tend to unravel. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of lodgepole pine/bitterbrush (PICO/PUTR) - 80 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC) - 10 percent and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 10 percent.

HABITAT TYPE DISTRIBUTION PICO/PUTR occurs throughout the unit. Cool climates, droughty soils and low timber productivity are associated with this HT in this unit.

Included are up to 20 percent dissimilar HTs. ABLA/VASC occurs on finer textured soils and is a more productive timber site. FEID/AGSP occurs in small grassland parks.

EXISTING VEGETATION consists of moderately open stands of lodgepole pine forest with scattered parks. All age classes of lodgepole pine are present in these stands. The forest understory is sparse and contains bitterbrush, pinegrass, and Idaho fescue. The scattered parks contain Idaho fescue, bluebunch wheatgrass, junegrass, and western needlegrass.

GEOLOGY

OCCURRENCE The unit contains glacial outwash and alluvial deposits - 100 percent.

The glacial outwash and alluvial deposits are derived primarily from obsidian and rhyolite rocks. They are Pleistocene or Holocene in age. These deposits are coarse textured and contain subrounded gravel and coarse sand. The surface is frequently mantled by a thin layer of silty loess.

Included are some dissimilar finer textured deposits. The soils formed in them are more productive.

SOILS

GENERAL NATURE OF SOILS Soils are excessively drained with moderately coarse and coarse textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains soils with light colored moderately coarse textured surface layers and moderately coarse textured subsoils underlain by coarse textured substrata. Included similar soils have coarse textured subsoils or some clay accumulations in the subsoil. The included soils are not obviously associated with landscape features. These soils occupy 90 percent of the unit.

Small areas of dissimilar soils are included. Medium textured soils are on finer textured alluvial deposits. They are more productive and less erodible. They occupy 10 percent of the unit.

GENERAL DESCRIPTION The surface layer is pale brown, coarse sandy loam about 1-4 inches thick. The upper subsoil is pale brown, very gravelly coarse sandy loam about 7 inches thick. The lower subsoil is pale brown very gravelly loamy coarse sand about 10 inches thick. The substratum, an extremely cobbly coarse sand, overlies bedrock at depths greater than 5 feet. See soil description 22 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, sandy skeletal siliceous. Included similar soils are Typic Cryorthents, sandy skeletal, siliceous; and Mollic Cryoboralfs, sandy skeletal, siliceous.

The included dissimilar medium textured soils are Typic Cryorthents, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 23-45 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited because of moisture stress. Soil productivity is dependent on the finer textured surface layers because of the coarse textured, infertile subsoils. Equipment operation may reduce productivity by redistributing the soil surface layers. Site preparation practices which do not redistribute the soil surface layer help maintain soil productivity.

ROADS The unit is well suited to road construction. Material exposed by road construction is difficult to revegetate. Special revegetation practices may be necessary to establish vegetation. Unsurfaced roads are dusty when dry. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Following timber harvest, production of the understory increases and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially fair summer moose and elk habitat. Grizzly bears are frequent visitors in the unit because of its proximity to suitable habitat. The unit does not normally contain trout habitat but borders streams that do.

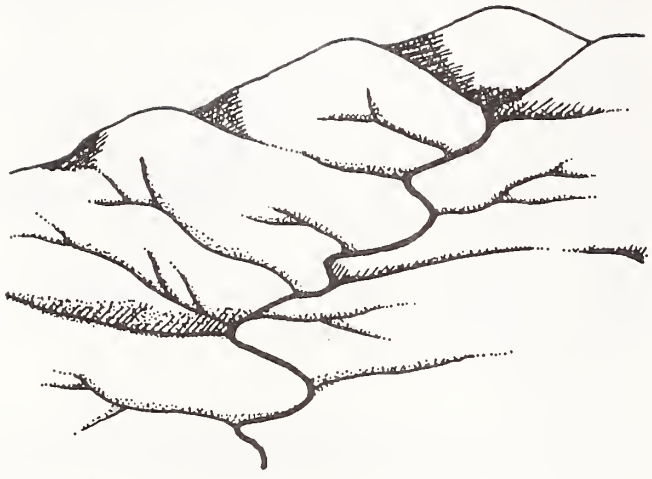
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	high
Sediment Delivery Efficiency	very low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-25
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	A



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 53-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep hills (block diagram). Delineations are mainly in the northern Madison Range, southwest Absaroka-Beartooth Range, and south of Hebgen Lake.

M.U. COMPONENTS This unit contains an association of soils and rock outcrop. Soils are medium to moderately fine textured with dark colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is mountain grassland and shrubland with some open grown Douglas-fir forest.

ADJOINING M.U. Adjacent units have forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Southern	6,800-7,800	15

The unit consists of rolling to moderately steep hills and small valleys Bedrock exposures are common on ridgetops. These hills are dissected by poorly defined intermittent streams. The drainage system has a dendritic pattern with moderate channel gradients. The landscape in some areas is rough and broken, suggesting old landslide deposits. These areas are stable. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 35 percent and big sagebrush/Idaho fescue (ARTR/FEID) - 25 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and Douglas-fir and subalpine fir HTs with low shrub understory unions - 25 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. Included as similar HTs are timber pine and Douglas-fir HTs with bunchgrass understory unions. Warm, dry climates and moderate range site productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. FEID/AGCA is on deeper soils or in moist locations and is a more productive range site. Douglas-fir or subalpine fir HTs with shrub understory unions occur in densely forested areas and are timber sites.

EXISTING VEGETATION consists of a mosaic of mountain grassland and shrubland with scattered forest. The mountain grasslands contain Idaho fescue, bluebunch wheatgrass, junegrass and western needlegrass. The mountain shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue. On moist sites, sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass also occur in the understory. The forested areas have an understory dominated by bunchgrasses or shrubs. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone, rhyolite, and diorite - 15 percent.

The bedrock consists of coarse grained rocks, such as, granite or gneiss of Precambrian age. Included as similar bedrocks are sandstone, rhyolite, and diorite. Also included are surficial deposits from old landslides.

Included bedrocks with dissimilar properties are micaceous schist and shale. These rocks weather to finer textured materials which are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with medium to moderately fine textures and dark colored surface layers. Subsoils contain 35-60 percent weathered subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit and occurs on ridgetops. Soil properties vary with topographic position. Soils formed on steeper sideslopes do not have subsoil accumulations of clay. These soils occupy 50 percent of the unit. Soils formed on benches and in shallow swales have subsoil clay accumulations. Included as similar are soils with very thick, dark colored surface layers and fewer subsoil rock fragments or lighter colored surface layers. These soils occupy 25 percent of the unit.

Included are up to 10 percent dissimilar soils. Moderately coarse textured soils occur near ridgetops. They are more erodible and less productive.

GENERAL DESCRIPTION The soils without subsoil clay accumulations have dark grayish brown, gravelly loam surface layers about 8 inches thick. Subsoils are brown, very cobbly sandy loam about 8 inches thick. The substratum, a brown, very cobbly sandy loam, overlies bedrock at depths greater than 5 feet. See soil description 14 for more detail.

The soils with subsoil clay accumulations have brown, very gravelly loam surface layers about 7 inches thick. Subsoils are very gravelly sandy clay loam about 12 inches thick. The substratum, a yellowish brown, very gravelly or very cobbly sandy loam or loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils without subsoil clay accumulations are Typic Cryoborolls, loamy skeletal, mixed. Included similar soils are Typic Cryoborolls, fine loamy, mixed. The soils with subsoil clay accumulation are Argic Cryoborolls, loamy skeletal, mixed. Included similar soils are Argic Pachic Cryoborolls, fine loamy mixed, and Mollic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,300 pounds per acre of dry herbage in normal years. Sagebrush control improves production of desirable forage plants and forage accessibility in some areas. Lack of stock water can limit livestock distribution.

WILDLIFE-FISHERIES This unit is potentially good winter mule deer and elk, and spring grizzly bear habitat. It is potentially good spring blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

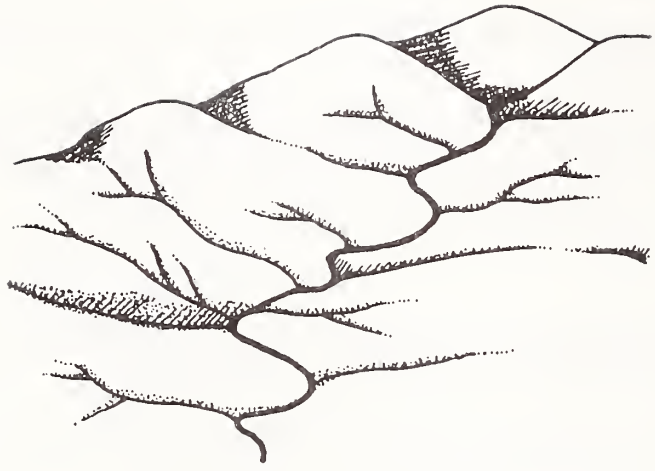
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 53-1D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep hills (block diagram). Delineations are mainly in the north central Gallatin Range, northern Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS Soils are moderately coarse to medium textured. They have formed in material weathered from hard crystalline rock. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units are steep with forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	6,100-7,800	5

The unit consists of rolling to moderately steep hills and small valleys Bedrock outcrops are limited to ridgetops. These hills are dissected by well defined, perennial streams. The drainage system has a dendritic pattern with moderate channel gradients. The landscape in some drainage ways is rough and broken, suggesting old landslide deposits. These areas have moderate landslide hazards. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/twinflower (ABLA/LIBO), and subalpine fir/pinegrass (ABLA/CARU) - 65 percent; subalpine fir/sitka alder (ABLA/ALSI) - 20 percent. Included HTs with dissimilar management implications are Douglas-fir HTs with shrubby understory unions and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/LIBO occur throughout the unit. ABLA/CARU is on southern exposures. Subalpine fir/grouse whortleberry (ABLA/VASC) is included as a similar HT. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit. ABLA/ALSI is in drainageways or near seeps. Seasonally wet soils and moderate timber productivity are associated with this HT in this unit.

Included are up to 10 percent dissimilar HTs. Douglas-fir HTs occur on lower elevation southern exposures and ABLA-PIAL/VASC is at higher elevations. These HTs are less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of a dense mat of blue huckleberry grouse whortleberry, twinflower, and pinegrass. Douglas fir forests are at lower elevations.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone, rhyolite, and diorite - 15 percent.

The bedrock consists of coarse grained rocks such as granite or gneiss of Precambrain age. Included similar bedrocks are sandstone, rhyolite, and diorite. Included are small areas of dissimilar landslide deposits in drainage ways. These deposits have moderate landslide hazards.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately coarse to medium textures. Subsoils contain 35-65 percent subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contsists of soils with light colored surface layers. Included similar soils have fewer subsoil rock fragments. The similar soils are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Small areas of dissimilar soils are included. Soils with finer textured subsoils which may contain fluctuating water tables are in drainage ways or on toe slopes. Moderate landslide hazards are associated with these soils in this unit. They occupy 20 percent of the unit.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is light brown, gravelly loam about 3 inches thick. The subsoil is very pale brown, very gravelly sandy loam about 29 inches thick. The substratum, a very pale brown, very cobbly loam, overlies bedrock at depths greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Typic Cryochrepts, coarse loamy, mixed.

The included dissimilar finer textured soils are Typic Cryoboralfs, loamy skeletal mixed. The soils with fluctuating water tables are Aquic Cryoboralfs.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53-69 cu. ft./acre. The unit is generally well suited to tractor operation. Soils in drainageways are subject to small landslides if disturbed. Regeneration is moderately limited by competition where alder or pinegrass is present. Timely site preparation helps overcome this limitation.

ROADS The unit is well suited to road construction. Material exposed by road construction is moderately erodible and tends to unravel on steep cutbanks. Revegetating cut and fill slopes and annual maintenance of the drainage system helps control erosion. There is a potential for cut and fill failures in moist drainage ways.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Following timber harvest, forage production increases and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially fair to good summer and fall elk and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Streams within the unit normally contain trout habitat. The unit also frequently borders streams containing suitable habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

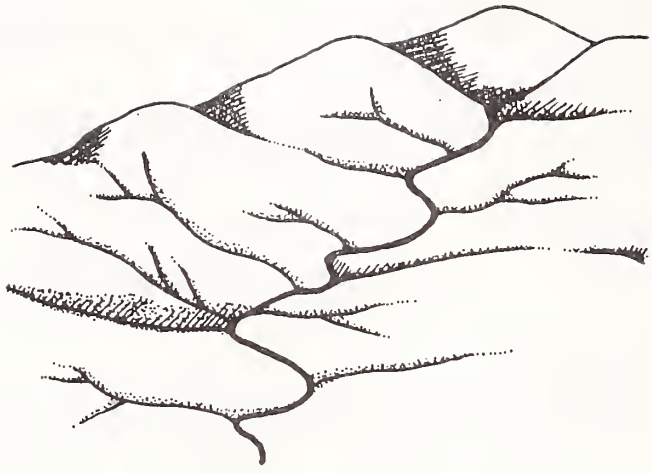
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	moderate
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 53-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep hills (block diagram). Delineations are mainly in the northern Madison Range, southwest Absaroka-Beartooth Range, and south of Hebgen Lake.

M.U. COMPONENTS The unit contains an association of soils. Soils are moderately fine textured with dark colored surface layers. They have formed in material weathered from volcanic rock. Native vegetation is mountain grassland and mountain shrubland.

ADJOINING M.U. Adjacent units have forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Southern	6,500-7,400	10

The unit consists of rolling to moderately steep hills and small valleys. Bedrock outcrops are occasionally found on ridgetops and upper slopes. These hills are dissected by poorly defined, intermittent streams. The drainage system has a dendritic pattern with moderate channel gradients. Some areas where the landscape is rough and broken indicate past landslide occurrence. These areas are now stable. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID) - 40 percent and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 35 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and subalpine fir (ABLA) and Douglas-fir (PSME) HTs with shrub understory unions - 15 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. Included similar HTs are Douglas-fir or limber pine HTs with bunchgrass understory unions. Warm, dry climates and moderately productive range sites are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. FEID/AGCA occurs on deeper soils or on concave slopes receiving runoff from higher ground. It is a more productive range site. Subalpine fir and Douglas-fir HTs with shrub understory unions occur in dense stands of trees. They have low timber productivity.

EXISTING VEGETATION consists of a mosaic of mountain shrubland and mountain grassland with scattered forest. The mountain shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbs. On moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are included in the understory. The mountain grasslands contain Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The forest consists of open grown to dense stands of limber pine, Douglas-fir or lodgepole pine with bunchgrass or shrub understories. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. The bedrock varies in weathering resistance. The lava flows are more resistant while the tuffs weather rapidly. Erodible soils and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS The soils are well drained, and moderately fine textured with dark colored surface layers. The subsoil contains 35-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with topographic position. Soils with moderately thick dark colored surface layers occur on convex slopes, benches, and ridgetops. They occupy 55 percent of the unit. Soils with very thick dark colored surface layers are in swales, small valleys, and draws. They occupy 30 percent of the unit. Included similar are soils have fewer subsoil rock fragments. These soils are not obviously associated with landscape features.

Included are up to 5 percent dissimilar soils. Shallow, moderately coarse textured soils occur near rock outcrops. They are more erodible and less productive timber and range sites.

GENERAL DESCRIPTION The soils with moderately thick dark colored surface layers have brown, loam surface layers about 7 inches thick. Subsoils are pale brown or reddish brown, very gravelly clay loam about 12 inches thick. The substratum, a light yellowish brown or pinkish gray very cobbly loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

The soils with very thick dark colored surface layers have brown loam or silt loam surface layers about 14 inches thick. Subsoils are brown or reddish brown, very gravelly silty clay loam about 17 inches thick. The substratum, a pale brown or light reddish brown very gravelly silt loam, overlies bedrock at depths greater than 5 feet. See soil description 19 for more detail.

CLASSIFICATION REMARKS The soils with moderately thick, dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed. The soils with very thick dark colored surface layers are Argic Pachic Cryoborolls, loamy skeletal, mixed. Included as similar are Argic Pachic Cryoborolls, fine loamy, mixed. The dissimilar shallow, moderately coarse textured soils are Lithic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads are slippery when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is well suited to range management. The potential native plant communities produce about 2,300 pounds per acre of air dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Lack of stockwater may limit access to forage. Sagebrush control can improve production and accessibility of desirable forage plants.

WILDLIFE-FISHERIES This unit is potentially good fall and winter mule deer and elk, and spring grizzly bear habitat. The unit is potentially good spring and summer blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat nor does it border streams containing habitat.

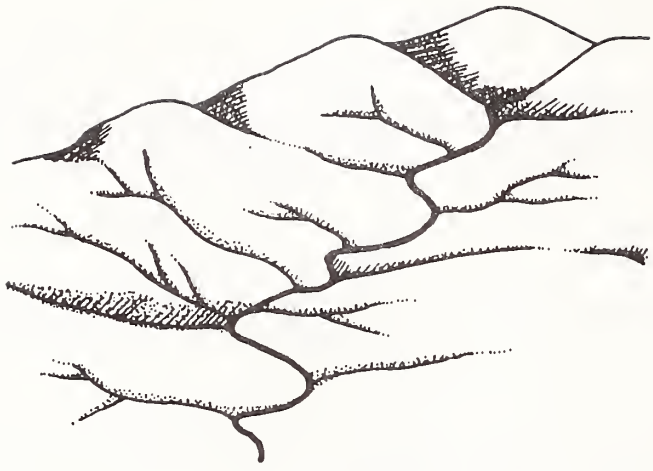
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 53-3B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep hills (block diagram). Delineations are mainly in the northern Madison Range, southwest Absaroka-Beartooth Range, and south of Hebgen Lake.

M.U. COMPONENTS This unit contains an association of soils. Soils are medium to moderately fine textured with dark colored surface layaers. They have formed in material weathered from volcanic rock. Native vegetation is dense lower subalpine forest on north aspects and open grown to dense Douglas-fir forest on south aspects.

ADJOINING M.U. Adjacent units have steep slopes with subalpine forest or mountain grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	North/South	6,500-7,800	5

The unit consists of rolling to moderately steep hills and small valleys. Bedrock outcrops are occasionally found on ridgetops and upper slopes. These hills are dissected by well defined, perennial streams. The drainage system has a dendritic pattern with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/grouse whortleberry (ABLA/VASC), and subalpine fir/twinflower (ABLA/LIBO) - 45 percent; Douglas-fir/snowberry (PSME/SYAL) - 35 percent. Included HTs with dissimilar management implications are subalpine fir/sweet scented bedstraw (ABLA/GATR); and Douglas-fir (PSME) HTs with grassy understory unions - 15 percent.

HABITAT TYPE DISTRIBUTION ALBA/VASC, ABLA/VAGL, and ABLA/LIBO are on northern exposures. Subalpine fir/pinegrass (ABLA/CARU) and Douglas-fir HTs with shrubby understory unions are included as similar. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit. PSME/SYAL is on southern exposures. Warm, moist climates and low timber productivity are associated with this HT in this unit.

Included are up to 15 percent dissimilar HTs. ABLA/GATR occurs on moist sites and is a more productive timber site. Douglas-fir HTs with bunchgrass understory unions occur on southern exposures and are less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest on northern exposures and open grown to dense Douglas-fir forest on southern exposures. On northern exposures the forest understory is dominated by shrubs. Forest understories on southern exposures it may be dominated by either shrubs or grasses.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The volcanic bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are more resistant while the tuffs weather rapidly. Erodible soils and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and medium to moderately fine textured. Subsoils contain 10-35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils formed under dense forest have somewhat darkened surface layers. Included similar soils have light colored surface layers. These soils occupy 50 percent of the unit. Soils formed under open grown forest have dark colored surface layers. Included similar soils have very thick dark colored surface layers. These soils occupy 35 percent of the unit.

Included are up to 10 percent dissimilar soils. Somewhat poorly drained soils are near seeps or in depressions on northern exposures. These soils have lower bearing strength and are more productive timber sites.

GENERAL DESCRIPTION The soils with somewhat darkened surface layers have pinkish gray loam surface layers about 14 inches thick. Subsoils are light reddish brown, clay loam about 22 inches thick. The substratum, a light reddish brown loam or gravelly loam, overlies bedrock at depths greater than 5 feet. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are light reddish brown, clay loam about 15 inches thick. The substratum, a light reddish brown or light yellowish brown gravelly clay loam or loam, overlies bedrock at depths greater than 5 feet. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with somewhat darkened surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Included similar soils are Argic Pachic Cryoborolls, fine loamy, mixed.

The included dissimilar somewhat poorly drained soils are Aquic Cryoboralfs or Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 54-90 cu. ft./acre on northern exposures and 13-41 cu. ft./acre on southern exposures. The unit is generally well suited to tractor operation. Regeneration is severely limited by moisture stress and competition on southern exposures. The dry environment in these areas can limit natural regeneration to years when seed production and precipitation are above average. Use of shelterwood or group selection harvesting systems improve regeneration success. Site preparation and planting immediately after harvest may also help.

ROADS The unit is well suited to road construction. Road surfaces are slippery when wet. Surfacing or seasonal closures can overcome this limitation.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Forage production increases after timber harvest and the unit is moderately suited to use as transitional range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer and elk habitat. It is potentially good fall blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

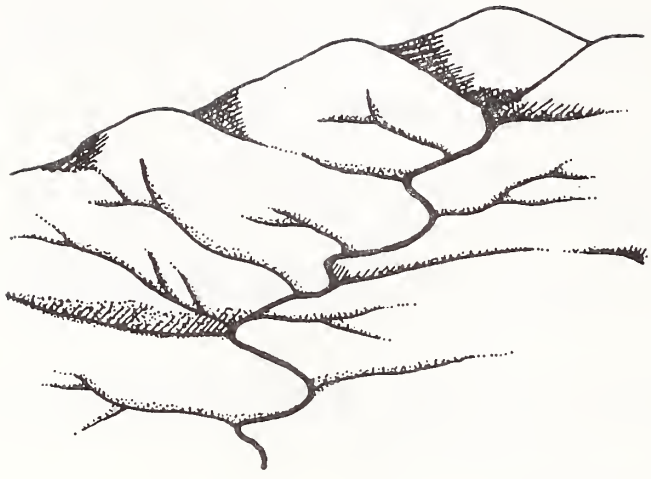
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 53-3C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep hills (block diagram). Delineations are mainly in the northern Madison Range, southwest Absaroka-Beartooth Range, and south of Hebgen Lake.

M.U. COMPONENTS This unit contains medium to moderately fine textured soils with subsoil clay accumulations. They have formed in material weathered from volcanic rock. Native vegetation is lower subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes with variably dense forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	6,500-7,800	5

The unit consists of rolling to moderately steep hills and small valleys. Bedrock outcrops are occasionally found on ridgetops and upper slopes. These hills are dissected by well defined perennial streams. The drainage system has a dendritic pattern with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/twinflower (ABLA/LIBO) and subalpine fir/grouse whortleberry (ABLA/VASC) - 80 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI), subalpine fir/bluejoint (ABLA/CACA), and Douglas-filr/ snowberry (PSME/SYAL) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA/LIBO and ABLA/VASC occur as a mosaic throughout the unit. Subalpine fir/blue huckleberry (ABLA/VAGL) is included as a similar HT. Cool, moist climates and moderate timber productivity are associated with these HTs.

Included are up to 15 percent dissimilar HTs. ABLA/ALSI and ABLA/CACA, are in wet draws and near seeps. They are associated with cool wet conditions and are more productive timber sites. PSME/SYAL is at lower elevations. It is associated with warm conditions and less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is composed of dense mats of grouse whortleberry, twinflower, and blue huckleberry.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 90 percent; hard crystalline bedrock - 10 percent.

The volcanic bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are more resistant while the tuffs weather rapidly. Erodible soils and landslide hazards are associated with weathered tuffs. Included are glacial till deposits which are similar in behavior. These deposits are in depressions and valley bottoms.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and medium to moderately fine textured. Subsoils contain 10-35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains soils that have somewhat darkened surface layers. Included similar soils have light colored surface layers and more subsoil rock fragments. These soils occupy 85 percent of the unit.

Included are up to 15 percent dissimilar soils. Moderately coarse textured soils occur in areas underlain by hard crystalline rocks. They are more erodible. Also included are moderately well to poorly drained soils in depressions or near seeps. These soils have lower bearing strength and are more productive timber sites.

GENERAL DESCRIPTION The major soils are covered with a layer of partially decomposed forest litter less than 1 inch thick. The surface layer is light brown loam about 14 inches thick. The subsoil is light reddish brown clay loam about 22 inches thick. The substratum, a light reddish brown loam or gravelly loam, overlies bedrock at depths greater than 5 feet. See soil description 6 for more detail.

CLASSIFICATION REMARKS The major soils are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed; Mollic Cryoboralfs, loamy skeletal, mixed; or Typic Cryoboralfs, loamy skeletal, mixed.

The included moderately coarse textured dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed. The soils in wet areas or near seeps are Argic Pachic Cryoborolls, Aquic Cryoboralfs, or Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53-71 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is limited by competition where alder is present. Timely site preparation helps overcome this limitation.

ROADS The unit is well suited to road construction. Road cut and fill failures are a hazard in moist drainage ways. Road design and location help overcome this limitation. Road surfaces are slippery when wet. Surfacing or seasonal closures overcome this limitation.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Forage production increases after timber harvest and the unit is well suited to use as transitory range.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall elk and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Streams within the unit normally contain trout habitat. The unit also frequently borders streams containing suitable habitat. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

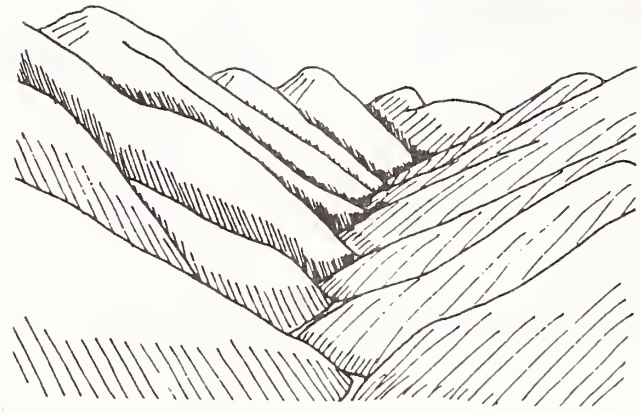
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram.) Delineations are mainly in the Bridger Range, northern Absaroka-Beartooth Range, northern Madison Range, and west of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured with dark to light colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is mountain grassland, mountain shrubland, and open grown Douglas-fir forest.

ADJOINING M.U. Adjacent units have forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	6,000-8,000	20

The unit consists of steep, rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrop occurs throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snow melt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 35 percent; and big sagebrush/Idaho fescue (ARTR/FEID) - 35 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA); Douglas-fir/snowberry (PSME/SYAL) or Douglas-fir/pinegrass (PSME/CARU) - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. Douglas-fir HTs with bunchgrass understory unions are included as similar. Warm, dry climates and moderate range productivity are associated with these HTs in this map unit.

Included are up to 10 percent dissimilar HTs. FEID/AGCA occurs on moist soils and is a more productive range site. PSME/SYAL and PSME/CARU occur in densely forested areas and have low timber productivity.

EXISTING VEGETATION consists of a mosaic of mountain shrubland and mountain grassland with scattered stands of Douglas-fir. The mountain grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbes. On moist sites, bearded wheatgrass, mountain brome and timber oatgrass are common. The mountain shrublands have sagebrush with understories dominated by Idaho fescue and common forbes. Bluebunch wheatgrass and junegrass also occur. Open growing stands of Douglas-fir have bunchgrass understories. Dense stands have shrub understories. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone, rhyolite, and diorite - 15 percent.

The bedrock consists of coarse grained rocks, such as, granite or gneiss of Precambrian age. Sandstone, rhyolite, and diorite are included similar bedrocks.

Included bedrocks with dissimilar properties are volcanic rocks and gravelly sandstones. Material weathered from these rocks is less erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 20 percent of the unit.

Soil properties vary with vegetation and landscape position. Soils with dark colored surface layers occur under grassland or open canopied Douglas-fir forest on lower slopes. They occupy 45 percent of the unit. Soils with light colored surface layers occur under open grown Douglas-fir forest or near rock outcrops on upper slopes. They occupy 30 percent of the unit. Included similar soils have clay accumulations in the subsoil or are shallow to bedrock.

Included are up to 5 percent dissimilar soils. Medium textured soils with light colored surface layers occur under dense forests and are more productive timber sites.

GENERAL DESCRIPTION The soils with dark colored surface layers have brown, very gravelly loam surface layers about 7 inches thick. Subsoils are light yellowish brown, very gravelly, sandy loam about 17 inches thick. The substratum, a very pale brown, very gravelly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 20 for more detail.

The soils with light colored surface layers have pale brown, gravelly sandy loam surface layers about 6 inches thick. Subsoils are light yellowish brown, very cobbly sandy loam about 15 inches thick. The substratum, a very pale brown, very cobbly sandy loam or loamy sand, overlies bedrock at depths of 2 to more than 5 feet. See Soil description 26 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Typic Haploborolls, loamy skeletal, mixed. The soils with light colored surface layers are Udic Ustochrepts, loamy skeletal, mixed, frigid. Included similar soils are Aridic Argiborolls, loamy skeletal, mixed and Lithic Ustochrepts, loamy skeletal, mixed, frigid.

The included dissimilar soils under dense forests are Typic Eutroboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation. Slope steepness increases the quantity of material excavated. The material exposed by road construction erodible and tends to ravel on steep cutbanks. Revegetation of cut and fill slopes and surfacing roads helps control erosion. Revegetation is limited by droughty, extreemly stony soils. Special revegetation practices can be necessary.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 1,400 pounds per acres of air dry herbage in normal years. Slope steepness severely limits access to forage. Livestock tend to concentrate on less steep areas. Drift fences, herding and salting away from water help overcome these limitations. Stock trails may erode. The forest understory produces little usable forage. Forage productivity of the understory in the included forested areas increases after timber harvest. These areas can be used for transitory range.

WILDLIFE-FISHERIES The unit is potentially good winter bighorn sheep, mule deer and elk habitat. It is potentially good spring and summer blue grouse habitat. It often There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

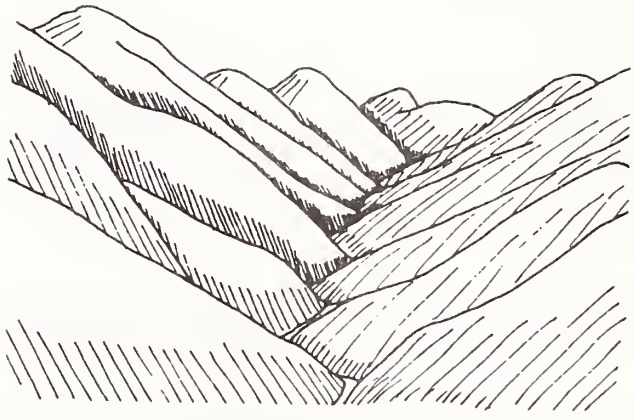
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	high
Hydrologic Soil Groups	A, B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the western Bridger Range, northeast Madison Range, west central Absaroka-Beartooth Range, and west of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of rock outcrop and soils. Soils are moderately coarse textured with light to dark colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is open grown Douglas-fir forest at lower and subalpine pine forests at higher elevations.

ADJOINING M.U. Adjacent units have densely forested slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	6,500-8,000	40

The unit consists of steep, rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Rock outcrops occur throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE. The unit consists of Douglas-fir (PSME) HTs with bunchgrass or shrub understory unions and subalpine fir (ABLA) HTs - 45 percent. Included HTs with dissimilar management interpretations are Idaho fescue/bluebunch wheatgrass (FEID/AGSP); big sagebrush/Idaho Fescue (ARTR/FEID) or subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 15 percent.

HABITAT TYPE DISTRIBUTION. PSME HTs occur at lower elevations and on southern or western exposures. ABLA HTs occur at higher elevations and on northern or eastern exposures. Warm, dry climates are associated with the PSME HTs and cool, dry climates with the ABLA HTs in this unit. Low timber productivity is associated with all HTs in this unit.

Included are up to 15 percent dissimilar HTs. FEID/AGSP and ARTR/FEID are in scattered parks. ABLA-PIAL/VASC is at higher elevations, and has lower timber productivity.

EXISTING VEGETATION consists of open grown stands of Douglas-fir forest at lower elevations or on southern or western exposures. Dense lodgepole pine forests are at higher elevations or on northern or eastern exposures. The forest understory is dominated by grasses or low shrubs. Many rock outcrops and mountain grassland or shrubland parks are scattered through the forest.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone, rhyolite, and diorite - 15 percent.

The bedrock consists of coarse grained rocks, such as, granite or gneiss of Precambrian age. Sandstone, rhyolite, and diorite are included similar bedrocks.

SOILS

GENERAL NATURE OF SOILS Soils are excessively to somewhat excessively drained, with moderately coarse textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of rock outcrop and soils. Rock outcrop occupies 40 percent of the Map Unit and is scattered throughout. Soil properties vary with vegetation. Soils with light colored surface layers are at higher elevations under dense forests. Included are similar soils with more acid or coarser textured subsoils. They occupy 35 percent of the unit. Soils with dark colored surface layers occur under open Douglas-fir forest or in parks. Included are similar soils with very thick, dark colored surface layers. They occupy 25 percent of the unit.

GENERAL DESCRIPTION The soils with light colored surface layers have brown, gravelly loam surface layers about 7 inches thick. Subsoils are very pale brown, very cobbly sandy loam about 13 inches thick. The substratum, a very pale brown, very cobbly sandy loam or loamy sand, overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

The soils with dark colored surface layers have dark grayish brown, gravelly loam surface layers about 8 inches thick. Subsoils are brown, very cobbly sandy loam about 8 inches thick. The substratum, a pale brown, very cobbly sandy loam or loamy sand, overlies bedrock at depths of 2 to more than 5 feet. See soil description 14 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Dystric Cryochrepts, loamy skeletal, mixed; and Typic Cryochrepts, sandy skeletal, mixed. The soils with dark colored surface layers are Typic Cryoborolls, loamy skeletal, mixed. Included similar soils are Pachic Cryoborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 16-52 cu.ft./acre. Slope steepness and rock outcrop severely limit equipment operation. Cable yarding systems can overcome these limitations. Regeneration is severely limited by moisture stress and grass competition. Natural regeneration can occur only in years when seed production is good and precipitation is above average. Use of shelterwood and group selection silvicultural systems, immediate site preparation and planting after harvest improve regeneration success.

ROADS The unit is poorly suited to road construction. Hard, non-rippable bedrock severely limits excavation and slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on steep cutbanks and is rough when used as native road surface. Revegetation of cut and fill slopes is limited by droughty, extremely stony material. Special practices can be required to reestablish vegetation.

RANGE The unit is moderately suited to range management. Slope steepness severely limits access by livestock. Drift fences, herding and salting away from water help overcome this limitation. The forest understory produces moderate amounts of forage and production increases following timber harvest. Stock trails can erode.

WILDLIFE-FISHERIES This unit is potentially good fall mule deer and elk fall and winter mountain goat habitat. It is potentially spring and summer good blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

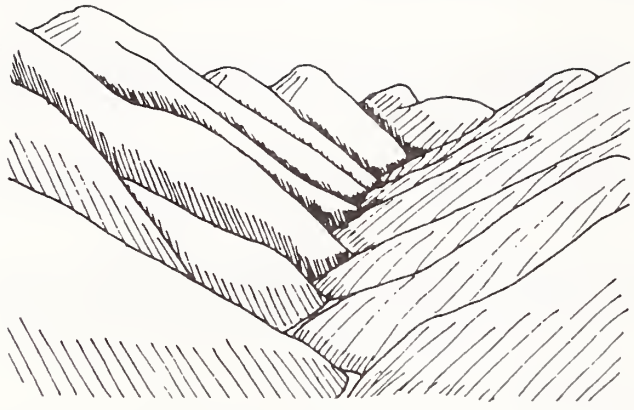
INTERPRETATIONS

Landslide Hazards	very low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	moderate
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	high
Hydrologic Soil Groups	A, B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the northern Gallatin Range, western Bridger Range, and west central Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured with light colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is dense Douglas-fir forest on north aspects, and open grown to dense Douglas-fir forest on south aspects.

ADJOINING M.U. Adjacent units have steep, densely forested slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	North/South	6,500-7,500	15

The unit consists of steep slopes that are long and straight to slightly convex Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrops occasionally are on ridgetops and near stream courses. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms are stable. They have little subsurface water storage capacity and surface runoff occurs during snowmelt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/snowberry (PSME/SYAL) - 45 percent and Douglas-fir/Idaho fescue (PSME/FEID) - 30 percent. Included HTs with dissimilar management implications are subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/sitka alder (ABLA/ALSI) - 10 percent.

HABITAT TYPE DISTRIBUTION. PSME/SYAL occurs on northern or eastern exposures, PSME/FEID occurs on southern or western exposures. Douglas-fir/ninebark (PSME/PHMA) is sometimes included with PSME/SYAL as a similar HT. Other Douglas-fir or limber pine HTs with bunchgrass understories are included with PSME/FEID as similar HTs. Warm, dry climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/VAGL and ABLA/ALSI occur at higher elevations on northern or eastern exposures. They are more productive timber sites.

EXISTING VEGETATION consists of dense stands of Douglas-fir or lodgepole pine forest with scattered rock outcrop. The forest understory consists of a mat of low shrubs on northern or eastern exposures and bunchgrasses on southern or western exposures.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline bedrock - 85 percent; sandstone, rhyolite, and diorite - 15 percent.

The bedrock consists of coarse grained rocks, such as, granite or gneiss of Precambrian age. Sandstone, rhyolite, and diorite are included as similar bedrocks.

Included bedrock with dissimilar properties is micaceous schist of Precambrian age. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit and occurs on ridgetops and upper slopes. The major soils have light colored slightly acid surface layers and moderately coarse textured subsoils. Included similar soils have moderately acid or coarser textured subsoils, or dark colored surface layers. They occupy 75 percent of the unit.

Included are up to 10 percent dissimilar soils. Finer textured soils occur in drainageways and in areas underlain by micaceous schist. They are less erodible and more productive timber sites. Delineations may consist entirely of this soil in the Crazy Mountains.

GENERAL DESCRIPTION The soil surface is covered by a partially decomposed forest litter layer less than 1 inch thick. The soils have brown, gravelly loam surface layers about 7 inches thick. Subsoils are very pale brown, very cobbly sandy loam about 13 inches thick. The substratum, a very pale brown, very cobbly sandy loam overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Dystric Cryochrepts, loamy skeletal, mixed; Typic Cryochrepts, sandy skeletal, mixed; and Typic Cryoborolls, loamy skeletal, mixed.

The dissimilar included finer textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 36 to 48 cu. ft./acre on northern or eastern exposures and 16 to 26 cu. ft/acre on southern or western exposures. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by moisture stress and understory competition. Natural regeneration can be limited to years when seed production is good and precipitation is above average. Use of shelterwood and group selection harvesting systems can improve regeneration success. Immediate site preparation and planting after harvest can also help.

ROADS The unit is moderately suited to road construction. Non-rippable bedrock moderately limits excavation. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special practices can be required to reestablish vegetation.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. Forest understory forage production is moderate on southern and western exposures and low on northern or eastern. Following timber harvest, forage production increases on all exposures.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer and fair fall elk habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

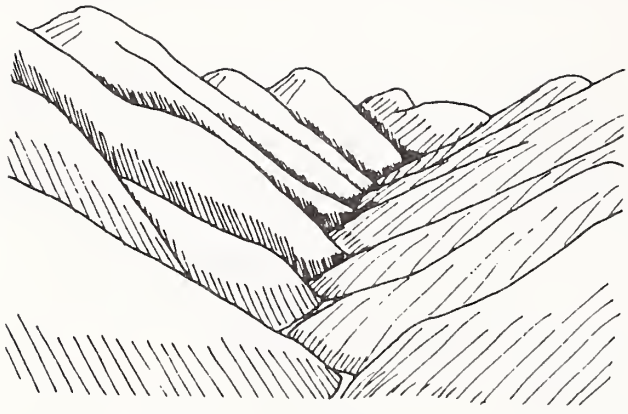
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low-moderate
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	March-April
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	high
Hydrologic Soil Groups	A, B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-1E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the western Bridger Range, throughout the Crazy Mountains, and around Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse textured with light colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is open grown to dense upper subalpine forest with scattered moist mountain meadows.

ADJOINING M.U. Adjacent units have gently sloping to steep slopes with dense forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,900	30

The unit consists of steep, rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrops are common throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snow melt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 65 percent. An included HT with dissimilar management implication is Idaho fescue/tufted hairgrass (FEID/DECA) - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs throughout the unit. Subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/pinegrass (ABLA/CARU) are similar included HTs at lower elevations and whitebark pine-subalpine fir (PIAL/VASC) is included as similar at higher elevations. Cold climates and low to moderate timber productivity are associated with these HTs in this unit.

Included are up to 5 percent dissimilar HTs. FEID/DECA occurs in mountain meadows.

EXISTING VEGETATION consists of open grown to dense whitebark pine and subalpine fir forest with scattered moist mountain meadows and rock outcrop. The forest understory is a moderately sparse mat of shrubs, forbs, and grasses dominated by grouse whortleberry, heartleaf Arnica and pinegrass. The meadows contain tufted hairgrass, Idaho fescue and a variety of forbs. On moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are common.

GEOLOGY

OCCURRENCE The unit is underlain by hard crystalline rocks - 70 percent; sandstone or rhyolite flows - 30 percent.

The hard crystalline bedrock consists of coarse grained, igneous rocks, such as granite, gneiss, or diorite of Precambrian or Tertiary age. Sandstone or rhyolite flows are included as similar bedrock.

Included bedrocks with dissimilar properties are thinly bedded shale and sandstone of the Livingston group. Material weathered from these rocks is less erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop and talus occupy 30 percent of the unit and occur throughout. The major soils have light colored surface layers and are moderately acid. Included similar soils are slightly acid, or coarse textured. They occupy 55 percent of the unit.

Included are up to 15 percent dissimilar soils. Finer textured soils occur in drainageways or areas underlain by thinly bedded sandstone and shale. They are less erodible. Delineations in the Crazy Mountains may consist entirely of these soils.

GENERAL DESCRIPTION The soil surface is covered with a partially decomposed forest litter layer less than 2 inches thick. The soils have brown, gravelly loam surface layers and pale brown, very cobbly sandy loam subsoils. The substratum, very pale brown, very cobbly sandy loam or loamy sand, is underlain by bedrock at depths of 2 to more than 10 feet. See soil description 23 for more detail.

CLASSIFICATION REMARKS The major soils are Dystric Cryochrepts, loamy skeletal, mixed. Included similar soils are Typic Cryochrepts, loamy skeletal, mixed or Typic Cryorthents, sandy skeletal, mixed.

The included dissimilar finer textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16-32 cu.ft./acre. Slope steepness and rock outcrop severely limit equipment operation. Cable or yarding systems can overcome this limitation. Regeneration is moderately limited by the harsh subalpine climate and droughty soils. Rock fragments on the surface or in the soil limit planting.

ROADS The unit is poorly suited to road construction. Hard, non-rippable bedrock severely limits excavation and slope steepness increases the quantity of material excavated. The material exposed by road construction tends to unravel on steep cutbanks and is rough when used as native road surface. Revegetation of cut and fill slopes is limited by droughty, extremely stony material. Special practices can be required to reestablish vegetation.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage.

WILDLIFE-FISHERIES This unit is potentially fair fall mule deer and elk habitat. It is potentially good summer and fall bighorn sheep and mountain goat habitat. It is fair fall blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

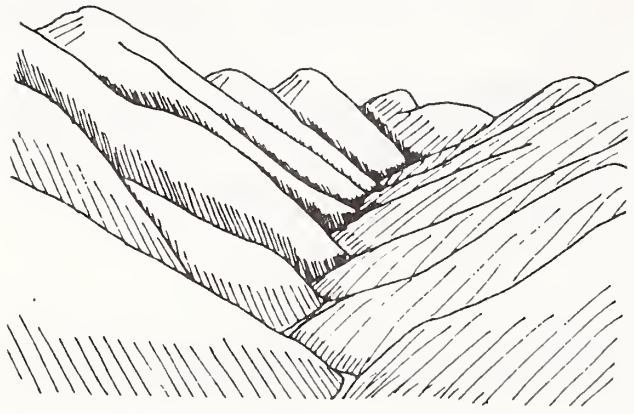
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivty	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	April-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-1G

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations occur throughout the Survey Area.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse to medium textured with light colored surface layers. They have formed in material weathered from hard crystalline rock. Native vegetation is dense lower subalpine forest on northern exposures and Douglas-fir forest on southern exposures.

ADJOINING M.U. Adjacent units have steep slopes with dense to sparse subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	5,600-8,000	15

The unit consists of steep, rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Rock outcrops occur on ridgetops and near stream courses. These slopes are dissected by poorly defined intermittent or perennial streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir grouse whortleberry (ABLA/VASC); subalpine fir/pinegrass (ABLA/CARU) - 60 percent. Included HTs with dissimilar management implications are subalpine fir/sitka alder (ABLA/ALSI) subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC), or Douglas-fir/snowberry (PSME/SYAL) - 25 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the map unit. ABLA/CARU is on southern exposures. Similar included HTs on northern exposures are subalpine fir/twinflower (ABLA/LIBO) at higher, and Douglas-fir/ ninebark (PSME/PHMA) at lower elevations. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. ABLA/ALSI occurs in draws or on northern exposures at higher elevations and is a more productive timber site. ABLA-PIAL/VASC is on high elevation ridges and slopes and is a less productive timber site. PSME/SYAL occurs on low elevation southern exposures and is a less productive timber site.

EXISTING VEGETATION consists of dense stands of lodgepole pine forest with some Douglas-fir forest at lower elevations on southern exposures. The forest understory under lodgepole pine forest is a thick mat of shrubs, dominated by grouse whortleberry and blue huckleberry. On southern exposures pinegrass dominates the understory. Under Douglas-fir forest it contains snowberry and other shrubs.

GEOLOGY

OCCURRENCE The map unit is underlain by hard crystalline rocks - 100 percent. The hard crystalline bedrock consists of coarse grained rocks, such as granite or gneiss of Precambrian age. Sandstone, rhyolite, and diorite are included as similar bedrock.

Included bedrocks with dissimilar properties are interbedded sandstone and shale. Material weathered from these rocks is less erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit on ridgetops and near streams. The major soils have light colored surface layers and are slightly acid. Included similar soils are moderately acid. These soils occupy 75 percent of the unit.

Included are up to 10 percent dissimilar soils. Finer textured soils are in areas underlain by interbedded shale and sandstone. They are less erodible and more productive timber sites.

GENERAL DESCRIPTION The soil surface is covered by a partially decomposed forest litter layer less than 1 inch thick. The soils have brown, gravelly loam surface layers about 7 inches thick. Subsoils are very pale brown, very cobbly sandy loam about 13 inches thick. The substratum, a very pale brown, very cobbly sandy loam overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Dystric Cryochrepts, loamy skeletal, mixed.

The included dissimilar finer textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53 to 85 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitations. Competition from alder limits regeneration in some areas. Timely site preparation helps overcome this limitation. Regenaration is severely limited by moisture stress and competition on lower elevation southern exposures. Natural regeneration can be limited to years when seed production and precipitation are above average.

ROADS The unit is moderately suited to road construction. Non-rippable bedrock moderately limits excavation. Slope steepness increases the quantity of material excavated. Cut and fill failures are a hazard in moist draws. Material exposed by road construction is moderately erodible. Seeding cut and fill slopes helps control erosion.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer fall elk habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

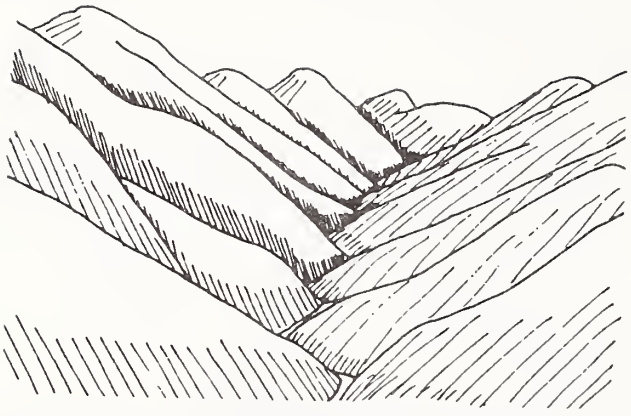
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-50
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of rock outcrop and soils. Soils are medium to moderately fine textured with high lime contents. They have formed in material weathered from limestone and sandstone. Native vegetation is open grown to dense Douglas-fir forest, mountain grassland and mountain shrubland.

ADJOINING M.U. Adjacent units have steep slopes with dense forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45	South or East	6,000-7,500	40

The unit consists of steep, rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock layers frequently form benches on these slopes. Bedrock exposures occur on these benches, in draws, and on ridgetops. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have moderate subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/Idaho fescue (PSME/FEID) - 25 percent; and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) or big sagebrush/Idaho fescue (ARTR/FEID) - 25 percent. Included HTs with dissimilar management implications are subalpine fir HTs with shrub or grass understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION PSME/SYAL and PSME/FEID occur throughout the unit in forested areas. ARTR/FEID occurs in shrublands and FEID/AGSP in grasslands. Included with grasslands as similar HTs are limber pine HTs with bunchgrass understory unions. Warm, dry climates and moderately productive range sites are associated with the grassland and shrubland HTs in this unit. Cool, dry climates and low timber productivity are associated with the forest HTs in this unit.

Included are up to 10 percent dissimilar HTs. Subalpine fir HTs occur on northern exposures at higher elevations. They are more productive timber sites.

EXISTING VEGETATION consists of a mosaic of open grown to dense Douglas-fir or lodgepole pine forest and mountain grassland and shrublands. The forest understory contains shrubs and bunchgrasses. Common juniper, snowberry, big sagebrush, Idaho fescue and bluebunch wheatgrass are dominant. The grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrublands have a big sagebrush canopy with an understory dominated by Idaho fescue and common forbs. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by limestone - 80 percent; sandstone and hard crystalline rocks - 20 percent.

The bedrock consists of thick beds of limestone of Paleozoic age. Typically they are from the Madison or older groups. Limey sandstones and thinly bedded shales are included similar bedrocks.

Included bedrocks with dissimilar properties are clean sandstone or hard crystalline rocks. These rocks weather to coarser textured material which is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with medium to moderately fine textures. Subsoils contain more than 35 percent rock fragments and are calcareous.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of rock outcrop and soils. Rock outcrop occupies 40 percent of the unit and occurs throughout. Soil properties vary with vegetation and bedrock type. Soils with light colored surface layers are under dense Douglas-fir forest in areas underlain by sandstone. Included are similar soils with non-calcareous subsoils. These soils occupy 20 percent of the unit. Soils with dark colored surface layers occur under grassland or Douglas-fir forest in areas underlain by limestone. Included are similar soils with somewhat lighter colored surface layers or soils with clay accumulations in the subsoil. These soils occupy 30 percent ot the unit.

Included are up to 10 percent dissimilar soils. Soils with light colored surface layers and subsoil clay accumulations are on lower slopes under dense Douglas-fir forest. They are on more productive timber sites.

GENERAL DESCRIPTION The soils with light colored surface layers have light brownish gray clay loam surface layers about 8 inches thick. Subsoils are calcareous brown, very gravelly clay loam about 14 inches thick. The substratum, a calcareous pinkish gray, very gravelly clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 25 for more detail.

The soils with dark colored surface layers have calcareous dark grayish brown, very gravelly silt loam surface layers about 11 inches thick. Subsoils are calcareous pale brown, very gravelly or very cobbly loam about 8 inches thick. The substratum, a calcareous very pale brown, very gravelly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 13 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Ustochrepts, loamy skeletal, mixed, frigid. The similar soils with non-calcareous subsoil are Udic Ustochrepts, loamy skeletal, mixed, frigid. The soils with dark colored surface layers are Typic Calciborolls, loamy skeletal, carbonatic. Included similar soils are Aridic Calciborolls, loamy skeletal, carbonatic or Typic Argiborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Eutroboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 16 to 48 cu. ft./acre. Slope steepness severely limits the use of equipment. Cable yarding systems can overcome this limitation. Moisture stress and grass competition severely limit regeneration. Use of shelterwood and group selection harvesting systems can improve regeneration success. Natural regeneration can be limited to years when seed production and precipitation are above average. Immediate site preparation and planting after harvest can also help.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation, and slope steepness increases the quantity of material excavated. The material exposed by road construction is difficult to revegetate. Special practices can be required to reestablish vegetation. Unsurfaced roads can be slick when wet. Surfacing or seasonal closures can help overcome this limitation.

RANGE The unit is moderately suited to range management. The grassland and shrubland produce about 1,245 pounds per acre of air dry herbage in normal years. Slope steepness and rock outcrop limit access to forage. Forest understories produces some forage. Forage production increases following timber harvest.

WILDLIFE-FISHERIES The unit is potentially fair fall and winter mule deer, and winter elk, bighorn sheep and mountain goat habitat. It is potentially good spring and winter blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs in the unit, it is a potential source of sediment which can damage fish habitat.

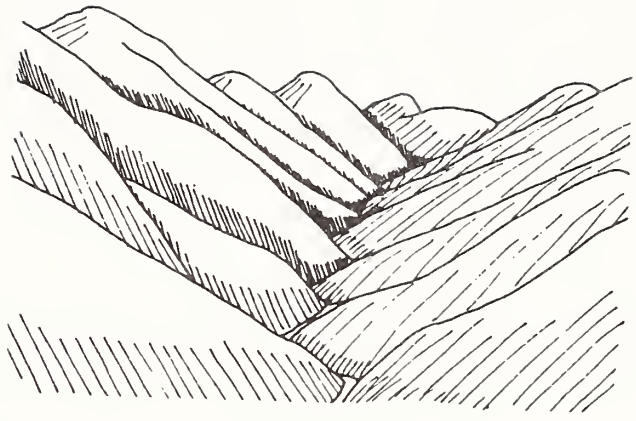
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	low
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate to high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the northern Gallatin Range, the southern Bridger Range, and the southern Madison Range.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse to medium textured with light colored surface horizons. They have formed in material weathered from limestone and sandstone. Native vegetation is open grown to dense subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes with dense to sparse subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,000-8,000	40

The unit consists of steep, rocky slopes that are long and straight to slightly convex Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock layers frequently form benches on these slopes. Bedrock outcrops are on benches, in draws, and on ridgetops. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have moderate subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/twinflower (ABLA/LIBO) and subalpine fir/pinegrass (ABLA/CARU) - 45 percent. Included HTs with dissimilar management implications are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/LIBO are on northern or eastern exposures. ABLA/CARU occurs on southern or western exposures. Subalpine fir/heartleafed arnica (ABLA/ARCO) and Douglas-fir/ninebark (PSME/PHMA), are similar included HTs. Cool climates and low to moderate timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. ABLA-PIAL/VASC is at higher elevations and is a less productive timber site.

EXISTING VEGETATION consists of sparse to dense lodgepole pine forest on northern or eastern exposures. Rhe forest understory is a sparse to dense mat of shrubs dominated by blue huckleberry or twinflower. On southern or western exposures, pinegrass dominates the understory.

GEOLOGY

OCCURRENCE The unit is underlain by limestone - 80 percent; sandstone and hard crystalline rocks - 20 percent.

The bedrock consists of thick beds of limestone of Paleozoic age. Typically they are from the Madison or older groups. Limey sandstone and thinly bedded shale are included similar bedrocks.

Included bedrocks with dissimilar properties are clean sandstone or hard crystalline rocks. These rocks weather to form coarse textured material which is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 40 percent of the unit and occurs throughout. The major soils have light colored surface layers and are deep. Included are similar soils with dark colored surface layers or shallow soils. They occupy 45 percent of the unit.

Included are up to 15 percent dissimilar soils. Finer textured soils are on lower slopes or in areas underlain by shale bedrock. They are on more productive timber sites.

GENERAL DESCRIPTION The soil surface is covered by a partially decomposed forest litter layer less than 1 inch. Surface soils are brown, silt loam about 7 inches thick. Subsoils are very pale brown, very cobbly silt loam about 13 inches thick. The substratum, a light gray, very cobbly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. These soils are often calcareous below 20 inches. See soil description 21 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Typic Cryoborolls, loamy skeletal, mixed and Lithic Cryochrepts, loamy skeletal, mixed.

The included dissimilar finer textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 33 to 63 cu. ft./acre. Steep slopes and rock outcrop severely limit equipment use. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by moisture stress.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock and rock outcrop severely limit excavation, and slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special practices may be necessary to reestablish vegetation. Unsurfaced roads can be slick when wet. Surfacing or seasonal closures can help overcome this limitation.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES The unit is potentially fair summer and fall mule deer and elk habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs within the unit, it is a potential source of sediment which can damage fish habitat.

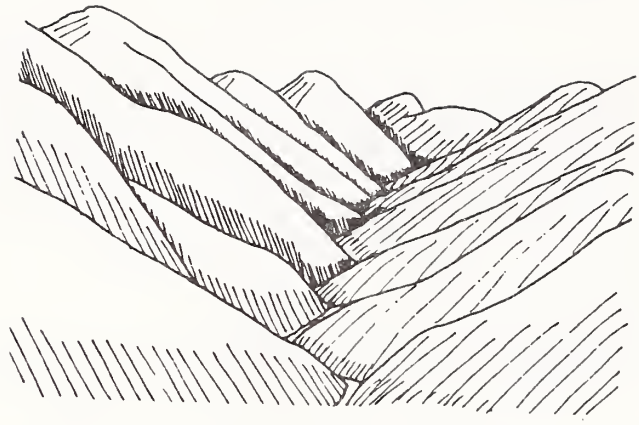
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low to high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-2D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the Gallatin Range and the southeast Madison Range in the Taylor Fork drainage.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured with dark to light surface layers. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is dense to open grown Douglas-fir forest and mountain grassland.

ADJOINING M.U. Adjacent units have dense forest vegetation with steep slopes or gentle slopes with grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	South	6,500-7,500	15

The unit consists of steep slopes that are long, and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Bedrock outcrops are on ridgetops and near stream courses. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have dispersed stability hazards on over 40 percent of the unit. Landslides occur frequently near seeps and springs. Old landslides are common. These landforms have little subsurface water holding capacity and surface runoff occurs during snowmelt. Runoff transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) or big sagebrush/Idaho fescue (ARTR/FEID) - 45 percent and Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/Idaho fescue (PSME/FEID) - 25 percent. Included HTs with dissimilar management implications are subalpine fir HTs with shrub or grass understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP occurs in mountain grasslands, and ARTR/FEID in mountain shrublands. Inclueded similar HTs in mountain grasslands are limber pine HTs with bunchgrass understory unions. Warm, dry climates and moderately productive range sites are associated with the grassland and shrubland HTs in this unit. PSME/SYAL and PSME/FEID occur throughout the unit in scattered forested areas. Cool, dry climates and low timber productivity are associated with the forest HTs in this unit.

Included are up to 10 percent dissimilar HTs. Subalpine fir HTs are on northern exposures at higher elevations. They are more productive timber sites.

EXISTING VEGETATION consists of a mosaic of mountain grassland and shrubland and open grown to dense Douglas-fir or lodgepole pine forest. The grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrublands have a sagebrush canopy with an understory dominated by Idaho fescue and common forbes. The forest understory contains shrubs and bunchgrasses. Common juniper, snowberry, big sagebrush, Idaho fescue, and bluebunch wheatgrass are dominant.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded sandstone and shale - 80 percent; and limestone - 20 percent.

The bedrock consists of thick, light colored sandstone interbedded with multi-colored shales. Multi-colored shale outcrops add color to the local landscape. Typical geologic formations are the Quadrant, formations of the Ellis group, Morrison, Kootenai, and Mowry-Thermopolis of Pennsylvanian to upper Cretaceous ages. The limestone is most often from the Madison group of Mississippian age. Included similar bedrocks are thinly interbedded, dark colored, sandstone and shale. The sandstone and limestone form ridges and outcrops. Landslide hazards are associated with shale bedrocks in this unit. Seeps often occur along the contact between sandstone and shale.

Included bedrock with dissimilar properties is white bentonitic shale of the Albino formation. This formation has higher landslide hazards.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with medium to moderately fine textures. Subsoils contain 20-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit and commonly occurs on side slopes, ridgetops and near stream courses. Soil properties vary with vegetation. Soils formed under mountain grassland, shrubland or open grown Douglas-fir forest have dark colored surface layers and moderately fine textures. Included similar soils have calcareous subsoils. These soils occupy 55 percent of the unit. Soils formed under dense Douglas-fir forest or near rock outcrops have light colored surface layers, medium textures, and calcareous subsoils. Included similar soils have noncalcareous subsoils. These soils occupy 20 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with light colored surface layers and subsoil clay accumulations occur under dense Douglas-fir or sparse limber pine forest. They are more productive timber sites and less productive range sites.

GENERAL DESCRIPTION The soils with dark colored surface layers have brown, silt loam surface layers about 9 inches thick. Subsoils are yellowish brown, silt loam or silty clay loam about 12 inches thick. The substratum, a yellowish brown, gravelly sandy clay loam, overlies bedrock at depths of 2 to more than 5 feet. Soil colors vary with bedrock color. See soil description 9 for more detail.

The soils with light colored surface layers have light brownish gray, gravelly silt loam surface layers about 8 inches thick. Subsoils are calcareous brown, very gravelly silt loam about 12 inches thick. The substratum, a calcareous light reddish brown, very gravelly or very cobbly loam, overlies bedrock at depths of 2 to more than 5 feet. Soil colors vary with bedrock color. See soil description 25 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Typic Argiborolls, fine loamy, mixed. Included similar soils are Typic Argiborolls, loamy skeletal, mixed or Typic Calciborolls, fine loamy, mixed. The soils with light colored surface layers are Typic Ustochrepts, loamy skeletal, mixed, frigid. Included similar soils are Udic Ustochrepts, loamy skeletal, mixed, frigid.

The included dissimilar soils with light colored surface layers and subsoil clay accumulations are Typic Eutroboralfs, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 16 to 48 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Moisture stress and understory competition severely limit regeneration. Use of shelterwood and group selection harvesting systems can improve regeneration success. Timely site preparation and planting can also help. The forest helps to stabilize unstable slopes. Timber harvest can increase the risk of landslides.

ROADS The unit is poorly suited to road construction. Unstable slopes occur frequently. Slope stability should be evaluated before locating roads. Slope steepness increases the quantity of material excavated. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank sloughing. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The mountain grassland and shrubland plant communities produce about 1,245 pounds per acre of air dry herbage in normal years. Slope steepness and lack of stockwater severely limit access to forage. Livestock tend to utilize only small inclusions of less steep slopes. In forested areas, the understory produces some forage. Forage production increases following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good fall and winter mule deer, and winter elk habitat. It is potentially good spring blue grouse habitat There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion or landslides occur, they are a potential source of sediment which can damage fish habitat.

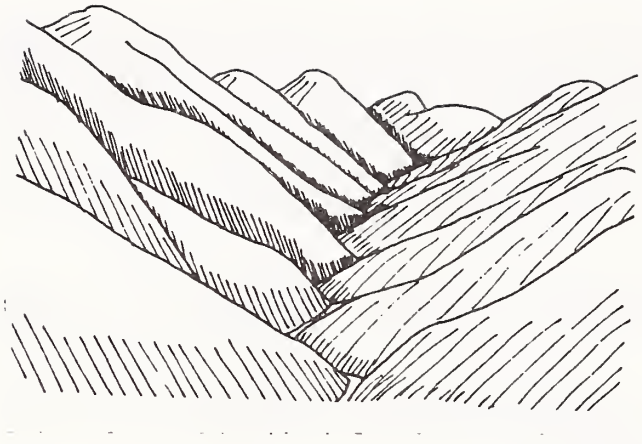
INTERPRETATIONS

Landslide Hazards	high
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate to high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-2E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of straight, steep slopes (block diagram). Delineations are mainly in the Gallatin Range, Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium and moderately fine textured with light colored surface layers. They are formed in material weathered from sandstone and shale bedrock. Native vegetation is dense to open grown lower subalpine forest.

ADJOINING M.U. Adjacent units have steep, densely forested slopes.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,000-8,000	15

The unit consists of steep slopes that are long and straight to slightly convex. forms. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Rock outcrops occur on ridgetops and near stream courses. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have a moderate landslide hazard. Landslides occur frequently near seeps and springs. These landforms have little subsurface water storage capacity but surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/pine grass (ABLA/CARU) - 75 percent. Included HT with dissimilar management implications are subalpine fir-whitebark pine/grouse whortlebery (ABLA-PIAL/VASC) and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/CARU occurs only southern exposures. Subalpine fir/heartleaf Arnica is included as a similar HT. Cool, moist climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA-PIAL/VASC occurs at higher elevations and is a less productive timber site. FEID/AGCA occurs in moist mountain meadows.

EXISTING VEGETATION consists of dense to open grown lodgepole pine forest with scattered moist mountain meadows and rock outcrop. The forest understory is a thick mat of shrubs, dominated by grouse whortleberry and blue huckleberry. Pinegrass dominates the understory on southern exposures.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded sandstone and shale - 85 percent; and limestone - 15 percent.

The bedrock consists of thick, light colored sandstone interbedded with some limestone and multi-colored shales. Multi-colored shale adds color to the local landscape. Typical geologic formations are the Quadrant formations of the Ellis group, Morrison, Kootenai, and Mowry-Thermopolis of Pennsylvanian to upper Cretaceous ages. The limestone is most often from the Madison group of Mississippian age. The sandstone and limestone form ridges and outcrops. Landslide hazards are associated with shale in this unit. Shale underlies concave slopes and seeps often occur along the contact between sandstone and shale beds.

Included bedrock with dissimilar properties is white bentonitic shale of the Albino formation. This formation has higher landslide hazards.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately coarse textures. Subsoils contain 20-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit on ridgetops, benches and near streams. Soil properties vary with bedrock properties and are not obviously associated with landscape features. Soils with light colored surface layers and subsoil clay accumulations are in areas underlain by shale. They occupy 55 percent of the unit. Soils with light colored surface layers and no subsoil clay accumulations are near rock outcrops and in areas underlain by sandstone. They occupy 30 percent of the unit.

GENERAL DESCRIPTION The soils with subsoil clay accumulation have very pale brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown, clay loam about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to more than 5 feet. Soil colors vary with bedrock color. See soil description 3 for more detail.

The soils without subsoil clay accumulations have brown, gravelly loam surface layers about 7 inches thick. Subsoils are pale brown, very gravelly loam or sandy loam about 13 inches thick. The substratum, a very pale brown, very gravelly or very cobbly sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils with subsoil clay accumulations are Cryoboralfs. The most common family is Typic Cryoboralfs, fine loamy, mixed. The soils without subsoil clay accumulations are Cryochrepts. The most common family is Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 52-70 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. The forest helps stabilize unstable slopes. Timber harvest may increase the risk of landslides. Competition limits regeneration in some areas.

ROADS The unit is moderately suited to road construction. Unstable slopes occur. Slope stability should be evaluated before planning or locating roads. Slope steepness increases the quantity of material excavated. Material exposed by road construction tends to slough on steep cutbanks and is erodible. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Seeding cut and fill slopes helps control erosion.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage. Production increases following timber harvest. The included moist mountain meadows are highly productive but of minor extent.

WILDLIFE-FISHERIES The unit is potentially fair summer and fall mule deer, and fall elk habitat. It is potentially good fall blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion or landslides occur, they are a potential source of sediment which can damage fish habitat.

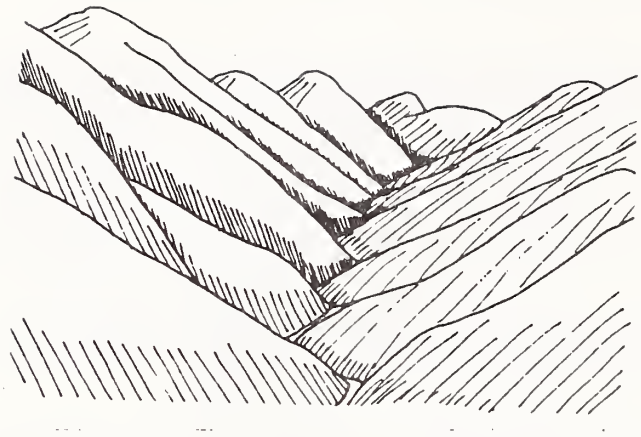
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low to high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the eastern Gallatin Range, southwest Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately fine textured with dark colored surface layers. They have formed in material weathered from volcanic rock. Native vegetation is mountain grassland and mountain shrubland, with some open grown Douglas-fir forest.

ADJOINING M.U. Adjacent units have steep slopes with dense to open grown Douglas-fir forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	6,500-7,500	15

The unit consists of steep slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Bedrock outcrops are on ridgetops and near stream courses. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 40 percent and big sagebrush/Idaho fescue (ARTR/FEID) - 35 percent. Included H.T. with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and subalpine fir or Douglas-fir HTs with shrub or forb understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. Included similar HTs are Douglas-fir or limber pine HTs with bunchgrass understory unions. Warm, somewhat moist climates and moderately productive range sites are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. FEID/AGCA occurs on moist sites and is a more productive range site. Douglas-fir or subalpine fir HTs with shrub or forb understory unions occur in densely forested areas.

EXISTING VEGETATION consists of a mosaic of mountain grassland and shrubland with some scattered forest. The grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrubland has a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbs. On moist sites, sticky geranium, bearded wheatgrass mountain brome and timber oatgrass are common. The included forest is Douglas-fir or limber pine. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are resistant while the tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contsists of a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit and occurs on ridgetops and near stream courses. Soil properties vary with topographic position. Soils with moderately thick, dark colored surface layers are on convex ridges and slopes. They occupy 55 percent of the unit. Soils with thick, dark colored surface layers are in swales, small valleys, draws, on old landslides and toe slopes. They occupy 20 percent of the unit.

Included are up to 10 percent dissimilar soils. Shallow soils with light colored surface layers occur near rock outcrops. They are less productive range sites.

GENERAL DESCRIPTION The soils with moderately thick, dark colored surface layers have very dark grayish brown, silt loam surface layers about 9 inches thick. Subsoils are brown, very gravelly silty clay loam about 12 inches thick. The substratum, a pale brown, very cobbly silt loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 10 for more detail.

The soils with very thick, dark colored surface layers have dark grayish brown, gravelly loam or silt loam surface layers about 14 inches thick. Subsoils are dark grayish brown, very gravelly clay loam about 11 inches thick. The substratum, a pale brown, very cobbly clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 12 for more detail.

CLASSIFICATION REMARKS The soil with moderately thick, dark colored surface layers are Typic Argiborolls, loamy skeletal, mixed. The soils with very thick, dark colored surface layers are Pachic Argiborolls, loamy skeletal, mixed.

The included dissimilar shallow soils are Lithic Ustochrepts, loamy skeletal, mixed, frigid.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is moderately suited to range management. The potential native plant communities in mountain grasslands produce 1,820 pounds per acre of air dry herbage in normal years. In mountain shrublands, annual production is 1,634 pounds per acre in normal years. Sagebrush control improves production and accessibility of desirable forage plants in some areas. Slope steepness severely limits access to forage. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome these limitations. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES The unit is potentailly good winter mule deer and elk and spring grizzly bear habitat. It is potentially good spring and summer blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which can damage fish habitat.

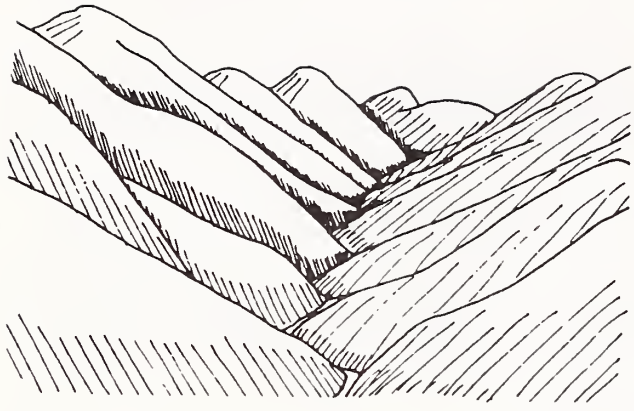
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-3C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the eastern Gallatin Range, and southwest Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured. They have formed in material weathered from volcanic rock. Native vegetation is open grown to dense Douglas-fir forest with some mountain grassland.

ADJOINING M.U. Adjacent units have steep slopes with dense Douglas-fir forest or grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,500-7,500	15

The unit consists of steep slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Bedrock outcrops occur throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with high channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/ snowberry (PSME/SYAL) and Douglas-fir/Idaho fescue (PSME/FEID) - 50 percent; and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) or big sagebrush/bluebunch wheatgrass (ARTR/FEID) - 20 percent. Included HTs with dissimilar management implications are subalpine fir HTs with grass or shrub understory unions - 15 percent.

HABITAT TYPE DISTRIBUTION PSME/SYAL occurs on northern or eastern exposures and PSME/FEID occurs on southern or western. FEID/AGSP and ARTR/FEID are on southern exposures at lower elevations. Cool, dry climates and low timber productivity are associated with the forest HTs in this unit. Moderately productive range sites are associated with the mountain shrubland and grassland HTs.

Included are up to 15 percent dissimilar HTs. Subalpine fir HTs with shrub or grass understory unions are at higher elevations. They are more productive timber sites.

EXISTING VEGETATION consists of open grown to dense Douglas-fir forest with scattered mountain grasslands or shrublands and rock outcrop. Some dense lodgepole pine forest is included. Dense Douglas fir forest occurs on northern or eastern exposures and open canopied Douglas fir forest occurs on southern or western exposures. The forest understory contains a sparse cover of shrubs and bunchgrasses with snowberry and Idaho fescue dominant. The mountain grasslands are dominated by bluebunch wheatgrass, Idaho fescue and common forbs. The mountain shrublands contain big sagebrush with a bunchgrass understory and common forbs. Douglas-fir seedlings frequently invade grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are resistant while the tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs in this unit.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contsists of a complex of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit and commonly occurs on ridgetops near stream courses and on benches. Soil properties vary with vegetation. Soils formed under Douglas-fir forest have somewhat light colored surface layers. They occupy 60 percent of the unit. Soils formed under grassland have dark colored surface layers. Included similar soils have very thick dark colored surface layers, and are in swales and on small benches. They occupy 20 percent of the unit.

Included are up to 5 percent dissimilar soils. Moderately coarse textured soils with light colored surface layers occur near rock outcrops. They are less productive timber sites.

GENERAL DESCRIPTION The soils with somewhat light colored surface layers have light reddish brown, gravelly silt loam surface layers about 6 inches thick. Subsoils are reddish brown, very gravelly silty clay loam about 11 inches thick. The substratum, a reddish brown, very gravelly silty clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 8 for more detail.

The soils with dark colored surface layers have very dark grayish brown, silt loam surface layers about 8 inches thick. Subsoils have brown, very gravelly silty clay loam subsoils about 8 inches thick. The substratum, a pale brown, very cobbly silt loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 10 for more detail.

CLASSIFICATION REMARKS The soils with somewhat light colored surface layers are Mollic Eutroboralfs, loamy skeletal, mixed. Soils with dark colored surface layers are Typic Argiborolls, loamy skeletal, mixed. Included similar soils are Pachic Argiborolls, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Udic Ustochrepts, loamy skeletal, mixed, frigid.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly to moderately suited to timber management. The potential annual production is 16 to 48 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by moisture stress and grass competition. Use of shelterwood and group selection harvesting systems can improve regeneration success. Immediate site preparation and planting after harvest can also help.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is moderately suited to range management. Slope steepness and rock outcrop severely limit accessibility of forage. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome these limitations. The shrubland-grassland communities produce 1,245 pounds per acre of air dry herbage in normal years. On forested sites, the understory produces little forage. Forage production increases following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good winter mule deer and elk habitat. It is potentially good spring and summer blue grouse habitat. There is also potentially good nesting habitat for clif nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which may damage fish habitat.

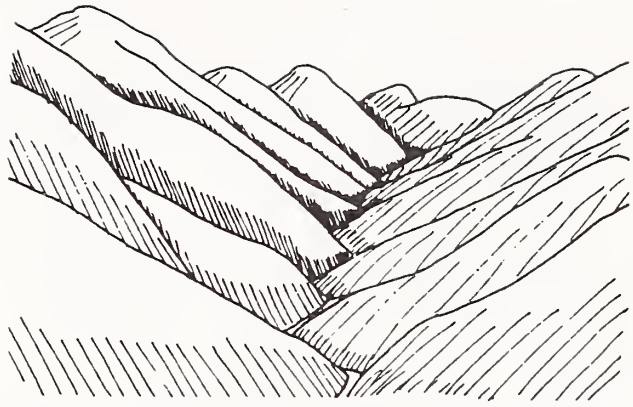
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-3D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations occur mainly throughout the Gallatin Range, and the western Absaroka-Beartooth Range.

M.U. COMPONENTS Soils are moderately fine textured with somewhat darkened surface layers. They have formed in material weathered from volcanic rock. Native vegetation is dense lower subalpine and Douglas-fir forest with some mountain meadows.

ADJOINING M.U. Adjacent units have dense upper subalpine forest vegetation or sparse Douglas-fir forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	6,500-7,800	10

The unit consists of steep slopes that are long, and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Bedrock outcrops occassionally occur on ridgetops and near stream courses. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/twinflower ABLA/LIBO) - 55 percent, and Douglas-fir/huckleberry (PSME/VAGL), - 25 percent. Included HTs with dissimilar management implications are Douglas-fir/Idaho fescue (PSME/FEID), subalpine fir/bluejoint (ABLA/CACA), or subalpine fir/sitka alder (ABLA/ALSI) - 5 percent; and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/LIBO occur at higher and PSME/VAGL at lower elevations. Douglas-fir/twinflower (PSME/LIBO) is an included similar HT at lower and subalpine fir/grouse whortleberry (ABLA/VASC) at higher elevations. Cool, moist climates and moderately productive timber sites are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/CACA and ABLA/ALSI occur along drainageways or in depressions. They are more productive timber sites. FEID/AGCA occurs in moist mountain meadows. PSME/FEID occurs on southern exposures at lower elevations and is a less productive timber site.

EXISTING VEGETATION consists of dense Douglas-fir or lodgepole pine forest with scattered moist mountain meadows. The forest understory is a dense mat of low shrubs dominated by blue huckleberry and twinflower. The moist meadows contain Idaho fescue, bearded wheatgrass, timber oatgrass, and shaky geranium.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are resistant while tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. Subsoils contain 15-40 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with somewhat dark colored surface layers and subsoils containing less than 35 percent rock fragments. Included are similar soils with slightly lighter colored surface layers or more subsoil rock fragments. They are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Included are up to 15 percent dissimilar soils. Soils with dark colored surface layers occur in meadows. Moderately coarse textured soils occur near rock outcrops. They are less productive timber sites.

GENERAL DESCRIPTION The soil surface is covered with decomposed forest litter, less than 1 inch thick. The surface layer is pale brown, silt loam about 12 inches thick. The subsoil is light yellowish brown, gravelly clay loam about 27 inches thick. The substratum, a brown or reddish brown, gravelly silty clay loam, overlies at depths of 2 to more than 5 feet. See soil description 6 for more detail.

CLASSIFICATION REMARKS The soils with somewhat dark colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed; and Mollic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed or Argic Pachic Cryoborolls, fine loamy, mixed. The moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed and Typic Cryoborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 53 to 75 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems may overcome this limitation.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Unstable slopes occur in drainageways. Slope stability should be evaluated before planning or locating roads. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The included meadows occupy less than 5 percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. The forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall moose and elk habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which may damage fish habitat.

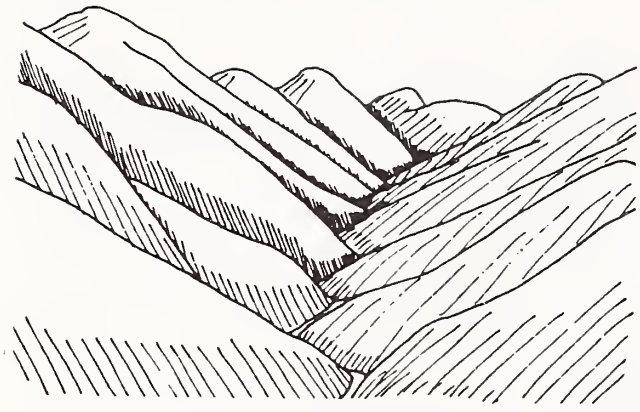
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low to moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-3E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of straight, steep slopes (block diagram). Delineations are mainly in the northeast Gallatin Range.

M.U. COMPONENTS Soils are moderately fine textured with dark or somewhat dark colored surface layers. They have formed in material weathered from volcanic rock. Native vegetation is dense to open grown upper subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes with open grown upper subalpine forest or dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,800-8,500	10

The unit consists of steep slopes that are long, and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Occasionally bedrock layers form benches on these slopes. Bedrock outcrops occassionally occur on ridgetops and near stream courses. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 65 percent. An included HT with dissimilar management implications is subalpine fir/grouse whortleberry (ABLA/VASC) - 25 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs throughout the unit. Whitebark pine-subalpine fir (PIAL-ABLA) is a similar included HT at higher elevations. Cold climates and low timber productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. ABLA/VASC occurs at lower elevations and is a more productive timber site.

EXISTING VEGETATION consists of a dense forest of stunted subalpine fir and whitebark pine with some Engleman spruce. Lodgepole pine forests are included at lower elevations. Forest stands are open growing on ridges and dense on lower slopes. The forest understory is a moderately sparse mat of shrubs and forbs dominated by Grouse whortleberry and lupine.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. The bedrock varies in weathering resistance. The lava flows are most resistant while the tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, and slightly acid with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

DCCURRENCE AND DISTRIBUTION The major soils have somewhat darkened surface layers. Included are similar soils with lighter or darker colored surface layers. These included soils are not obviously associated with landscape features. These soils occupy 75 percent of the unit.

Included are up to 20 percent dissimilar soils. Moderately acid soils with coarser textures occur near bedrock outcrops and are more erodible.

GENERAL DESCRIPTIDN The soil surface is covered with a layer of partially decomposed forest litter less than 1 inch thick. The soils have light brown, silt loam surface layers about 5-10 inches thick. Subsoils are light yellowish brown, very gravelly clay loam subsoils about 5-25 inches thick. The substratum, a light yellowish brown or pinkish gray, very gravelly silty clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 7 for more detail.

CLASSIFICATIDN REMARKS The major soils are Mollic Cryoboralfs, loamy skeletal, mixed. The similar included soils are Typic Cryoboralfs, loamy skeletal, mixed and Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Dystric Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 16-32 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by the harsh subalpine climate. Individual trees are often poorly formed and have spiral grain.

RDADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special practices can be necessary to reestablish vegetation.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. The forest understory produces little forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good fall grizzly bear, goat, and bighorn sheep, and fair summer elk habitat. It is potentially good fall blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which can damage fish habitat.

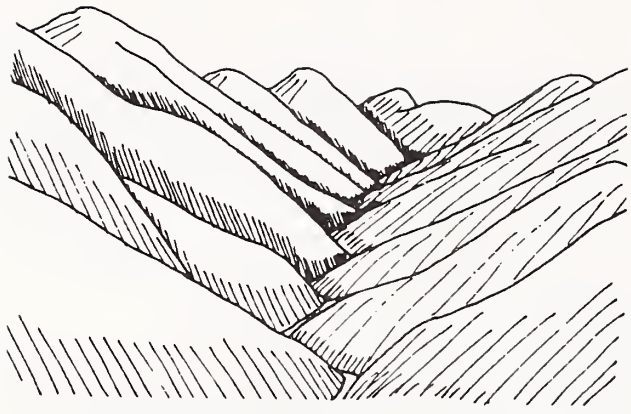
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-50
Precipitation Distribution	8D% snow; 20% rain
Average Winter Snow Depth (inches)	6D+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	low-high



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-3F

MAP UNIT SUMMARY

M.U. SETTING The landform consists of straight, steep slopes (block diagram). Delineations occur mainly throughout the Gallatin Range and the western Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of rock outcrop and soils. Soils are moderately coarse to moderately fine textured with dark to light colored surface layers. They have formed in material weathered from volcanic rock. Native vegetation is open grown to dense subalpine or Douglas-fir forest and mountain grassland.

ADJOINING M.U. Adjacent units have steep slopes and dense subalpine forest or grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,800-8,000	40

The unit consists of steep rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrops occur throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have little subsurface water storage capacity and surface runoff occurs during snowmelt. Runoff rapidly transports eroded soil to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/pinegrass (ABLA/CARU) - 30 percent; subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 15 percent. Included HTs with dissimilar management implications are Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 10 percent; and Douglas-fir (PSME) HTs that have open forest canopies - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA/CARU occurs mainly on southern exposures, but occassionally on other exposures at mid elevations. ABLA-PIAL/VASC occurs at higher elevations. Cool, dry to moist climates and low to moderate timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. FEID/AGSP occurs in grassland parks on benches with southern exposures. Douglas-fir HTs with bunchgrass or shrub understory unions occur at lower elevations. They are less productive timber sites.

EXISTING VEGETATION consists of open grown to dense lodgepole pine forest with scattered grassland parks and rock outcrop. On southern exposures the understory is dominated by pinegrass. On other exposures it is a sparse to moderately dense mat of low shrubs and grass dominated by grouse whortleberry and pinegrass. In some areas, subalpine fir seedlings are invading the small mountain grassland parks. Open grown Douglas fir forest is at lower elevations.

GEOLOGY

OCCURRENCE The unit is underlain by volcanic bedrock - 100 percent.

The bedrock consists of a repetitive sequence of lava flows, mudflow breccias, and welded tuffs of Tertiary age. The welded tuffs occur in isolated layers and are not often exposed. This bedrock varies in weathering resistance. The lava flows are most resistant while the tuffs weather rapidly. Erodible material and landslide hazards are associated with weathered tuffs.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of rock outcrop and soils. Rock outcrop and talus occupy 40 percent of the unit and occur throughout the unit. Soil properties vary with vegetation. Soils formed in meadows and under open canopied forest have dark colored surface layers. They occupy 30 percent of the unit. Soils formed under dense forest vegetation have somewhat lighter colored surface layers. They occupy 20 percent of the unit.

Included are up to 10 percent dissimilar soils. Moderately coarse textured soils of variable depth occur near rock outcrops, and are less productive timber sites.

GENERAL DESCRIPTION The soils with dark colored surface layers have brown, loam surface about 7 inches thick. Subsoils are pale brown or reddish brown, very gravelly clay loam about 12 inches thick. The substratum, a light yellowish brown or pinkish gray, very cobbly loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 17 for more detail.

The soils with somewhat dark colored surface layers have light brown, silt loam surface about 9 inches thick. Subsoils are light yellowish brown very gravelly clay loam, about 29 inches thick. The substratum, a light yellowish brown or pinkish gray, very gravelly silty clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 7 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed. The soils with somewhat darker surface layers are Mollic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryoborolls, loamy skeletal, mixed; Typic Cryochrepts, loamy skeletal, mixed; Lithic Cryoborolls, loamy skeletal, mixed; or Lithic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 36 to 64 cu. ft./acre. Slope steepness and rock outcrop severely limit equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited because of understory competition. Shelterwood or group selection silvicultural systems can help overcome this limitation. Timely site preparation and planting can also help.

ROADS The unit is poorly suited to road construction. Bedrock outcrops severely limit road placement. Slope steepness increases the quantity of material excavated. The material exposed by road construction is slippery when wet and rough on road surfaces. Surfacing or seasonal closures overcome this limitation.

RANGE The unit is poorly suited to range management. The included grasslands occupy less than 10 percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. Slope steepness, rock outcrop and lack of stockwater severely limit access to forage. Livestock tend to concentrate on small included less sloping areas.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer and fall bighorn sheep and elk habitat. It is good fall blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which may damage fish habitat.

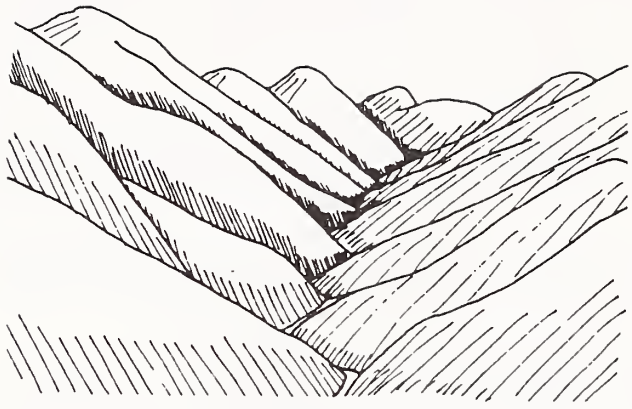
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-5A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, straight slopes (block diagram). Delineations are mainly in the Deer Creek area with some in the Crazy Mountains.

M.U. COMPONENTS The unit contains an association of soils and rock outcrop. Soils are moderately coarse to medium textured with dark and light colored surface layers. They have formed in material weathered from thinly bedded sandstone and shale. Native vegetation is mountain grassland and open grown Douglas-fir forest on south aspects and dense Douglas-fir forest on north aspects.

ADJOINING M.U. Adjacent units have steep slopes with dense forest vegetation, or gentle slopes with grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	North/South	5,200-6,200	20

The unit consists of steep rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrops occur throughout the unit. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have moderate subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/ninebark (PSME/PHMA) - 35 percent and Douglas-fir/Idaho fescue (PSME/FEID) - 30 percent. Included HTs with dissimilar management implications are Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 15 percent.

HABITAT-TYPE DISTRIBUTION PSME/PHMA occurs on northern exposures. Douglas-fir/ snowberry (PSME/SYAL) is an included similar HT. Warm, dry to moist climates and low to moderate timber productivity are associated with these HTs in this unit. PSME/FEID occurs on southern exposures. Included similar HTs are other Douglas-fir, limber pine and ponderosa pine HTs with bunchgrass understory unions. Warm, dry climates and very low timber productivity are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. FEID/AGSP and big sagebrush/Idaho fescue (ARTR/FEID) occur in mountain grasslands or shrublands on southern exposures.

EXISTING VEGETATION consists of dense to open grown Douglas-fir forest with scattered mountain grassland and rock outcrop. Dense Douglas-fir forests with shrub understories dominated by ninebark and snowberry are on northern exposures. Open grown Douglas-fir forests with bunchgrass understories dominated by Idaho fecue and bluebunch wheatgrass are on southern exposures. Mountain grasslands dominated by Idaho fescue and bluebunch wheatgrass are included on southern exposures. Douglas-fir seedlings are invading these grasslands.

GEOLOGY

OCCURRENCE The unit is underlain by sandstone and shales - 90 percent; volcanic rocks and hard crystalline rocks - 10 percent.

The principal bedrock consists of dark colored sandstone interbedded with thin beds of shale and siltstone. These rocks are part of the Livingston group and are Tertiary in age. Volcanic rocks are included similar bedrocks.

Included bedrocks with dissimilar properties are hard crystalline rocks. These occur scattered throughout the unit as dikes and sills. They form ridgetops. The material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils and rock outcrop. Rock outcrop occupies 20 percent of the unit. Soil properties vary with vegetation. Soils formed under grassland or open grown Douglas-fir forest have dark colored surface layers and subsoil clay accumulations. They occupy 40 percent of the unit. Soils formed under dense Douglas-fir forest have somewhat darkened surface layers and subsoil clay accumulations. They occupy 30 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with light colored surface layers or shallow soils are near rock outcrops and on high ridges. They are more erodible and less productive timber sites.

GENERAL DESCRIPTION The soils with dark colored surface layers have very dark grayish brown, loam surface layers about 8 inches thick. Subsoils are brown, very gravelly clay loam about 8 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 10 for more detail.

The soils with somewhat dark colored surface layers have pale brown, loam surface layers about 9 inches thick. Subsoils are light yellowish brown, very gravelly clay loam about 20 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 8 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Typic Argiborolls, loamy skeletal, mixed. The soils with somewhat dark colored surface layers are Mollic Eutroboralfs, loamy skeletal, mixed.

The included dissimilar soils with light colored surface layers are Udic Ustochrepts, loamy skeletal, mixed. The shallow soils are Lithic Ustochrepts, loamy skeletal, mixed; or Lithic Haploborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 16 to 60 cu. ft./acre. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Regeneraion is moderately limited by moisture stress and understory competition. Shelterwood and selection silvicultural systems can improve regeneration success.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Rock outcrop and shallow bedrock moderately limit excavation. The material exposed by road construction is erodible in some areas. Seeding cut and fill slopes helps control erosion. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is moderately suited to range management. Slope steepness severely limits access to forage. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome these limitations. The forest understory produces moderate amounts of forage and production increases after timber harvest.

WILDLIFE-FISHERIES This unit is potentially good all season mule deer and good winter elk habitat. It is good spring and summer blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which can damage fish habitat.

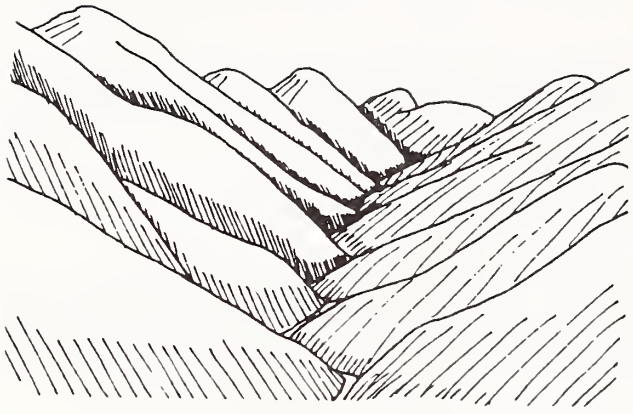
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	10-20
Precipitation Distribution	40% snow; 60% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	120+
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 54-5C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep straight slopes (block diagram). Delineations are mainly in the the Deer Creek Mountains.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately coarse to medium textured with light or somewhat dark colored surface layers. They have formed in material weathered from thinly bedded sandstone and shale. Native vegetation is dense Douglas-fir forest on north aspects and open grown Douglas-fir forest on south aspects.

ADJOINING M.U. Adjacent units have steep slopes with sparse forest vegetation, or gentle slopes with grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	North/South	6,000-7,500	25

The unit consists of steep rocky slopes that are long and straight to slightly convex. Major streams are often at the base of these slopes. These slopes form "V" shaped valleys. Bedrock outcrops occur throughout the unit. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel to dendritic pattern with steep channel gradients. These landforms have moderate subsurface water holding capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/ninebark (PSME/PHMA) - 50 percent; and Douglas-fir/Idaho fescue (PSME/FEID) - 15 percent. An included HT with dissimilar management implications is subalpine fir/blue huckleberry (ABLA/VAGL) - 10 percent.

HABITAT TYPE DISTRIBUTION PSME/PHMA occurs on northern exposures. Douglas-fir/ snowberry (PSME/SYAL) is an included similar HT. Warm, moist climates and moderately productive timber sites are associated with these HTs in this unit. PSME/FEID occurs on southern exposures. Douglas-fir/bluebunch wheatgrass (PSME/AGSP) is an included similar HT. Warm, dry climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA/VAGL occurs at higher elevations and is a more productive timber site.

EXISTING VEGETATION consists of dense to open grown Douglas-fir forest with scattered rock outcrop. Dense Douglas-fir forests with shrub understories dominated by ninebark and snowberry occur on northern exposures. Open grown Douglas-fir forests with bunchgrass understories dominated by Idaho fescue, bluebunch wheatgrass, and junegrass occur on southern exposures.

GEOLOGY

OCCURRENCE The unit is underlain by sandstone and shale - 90 percent; volcanic and hard crystalline rock - 10 percent.

The bedrock consists of dark colored sandstone interbedded with shale and siltstone. These bedrocks are part of the Livingston group and are Tertiary in age. Volcanic rocks are included as similar.

Included bedrock with dissimilar properties are hard crystalline rocks. They are scattered throughout as dikes and sills. They form ridgetops. The material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately coarse to medium textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 25 percent of the unit. Soil properties vary with vegetation. Soils with somewhat dark colored surface layers and subsoil clay accumulations are under open grown Douglas-fir forests. Included similar soils have dark colored surface layers. These soils occupy 35 percent of the unit. Soils with light colored surface layers and subsoil clay accumulations occur under dense Douglas-fir forest. These soils occupy 25 percent of the unit.

Included are up to 15 percent dissimilar soils. Soils without subsoil clay accumulations occur near rock outcrops. They are less productive and more erodible.

GENERAL DESCRIPTION The soils with somewhat dark colored surface layers have light brownish gray loam surface layers about 9 inches thick. Subsoils are yellowish brown, very gravelly clay loam about 29 inches thick. The substratum, a very pale brown, very gravelly clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 7 for more detail.

The soils with light colored surface layers have brown loam surface layers about 11 inches thick. Subsoils are yellowish brown, very gravelly clay loam about 12 inches thick. The substratum, a very pale brown, very gravelly or very cobbly clay loam or loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 4 for more detail.

CLASSIFICATION REMARKS The soils with somewhat dark colored surface layers and subsoil clay accumulations are Mollic Cryoboralfs, loamy skeletal, mixed. The included soils are Argic Cryoborolls, loamy skeletal, mixed. The soils with light colored surface layers and subsoil clay accumulations are Typic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils without subsoil clay accumulations are Typic Cryochrepts, loamy skeletal, mixed and Typic Haploborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 42 to 60 cu. ft./acre on northern exposures and 16 to 26 on southern exposures. Slope steepness severely limits equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by understory competition. Shelterwood or group selection silvicultural systems and site preparation and planting immediately after harvest help improve regeneration success.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Rock outcrop and shallow bedrock moderately limit excavation. The material exposed by road construction is erodible. Revegetation of cut and fill slopes helps control erosion. Unsurfaced roads are slippery when wet. Surfacing or seasonal closures overcome this limitation.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome these limitations. The forest understory on northern exposures produces little forage. On southern exposures understory forage production is moderate. Following timber harvest, forage productivity of the understory increases.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If soil erosion occurs, it is a potential source of sediment which can damage fish habitat.

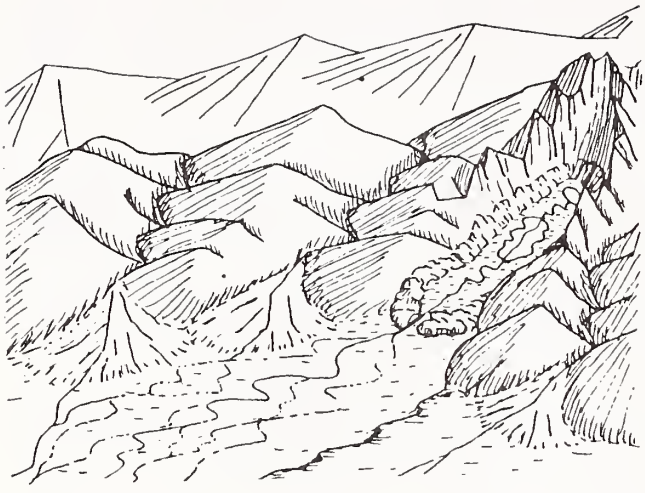
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	25-60
Spring Runoff	April-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 61-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping alluvial fans (center left portion of the block diagram). Delineations are mainly in the northern Absaroka-Beartooth Range, eastern Madison Range, and around Hebgen Lake.

M.U. COMPONENTS Soils are moderately coarse to moderately fine textured. They are formed in alluvial deposits derived form sandstone, limestone, and shale. Native vegetation is mountain shrubland, mountain grassland, and open grown Douglas-fir forest.

ADJOINING M.U. Adjacent units have steep, rocky slopes with forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-20	Variable	5,400-6,500	0

The unit consists of smooth, gently sloping, fan shaped deposits at the base of steep slopes. They occur at the mouths of steep stream courses that empty onto valley floors. Some glacial till deposits are on upper slopes in the unit. These alluvial fans are dissected by poorly defined intermittent streams that frequently change channels. These channels are braided with moderate gradients. This landform has high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID) - 30 percent; Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 30 percent; and Douglas fir with shrubby or grassy understories - 30 percent. Included HTs with dissimilar management implications are subalpine fir with grassy or shrubby understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID and FEID/AGSP occur in a mosaic throughout the unit. Douglas-fir HTs are included as similar. Warm, somewhat dry climates and modrately productive range sites are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. Subalpine fir HTs are at higher elevations. They are most productive as timber sites.

EXISTING VEGETATION consists of a mosaic of mountain grasslands and shrublands with open grown subalpine fir or Douglas-fir forest. The grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrss, western needlegrass and common forbs. The shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbs. On more moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are included. The forest has an understory dominated by low shrubs or grasses. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit contains alluvial fan deposits - 85 percent; glacial till or other alluvial deposits - 15 percent.

These alluvial fan deposits are derived primarily from shale, sandstone, or limestone. They are Pleistocene and Holocene in age. These deposits are variable in texture and contain numerous boulders, cobbles, and pebbles. Some glacial till is included as similar to the fan deposits.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, with variable textures. Subsoils contain 35-60 percent rock fragments and are calcareous.

OCCURRENCE AND DISTRIBUTION The unit contains an undifferentiated group of soils with subsoils containing variable amounts of lime. Soils with very limey subsoils occur in the Bridger Mountains and northen Absaroka-Beartooths, where the parent material originates primarily from limestones. In other areas, the subsoils are only moderately limey. All soils have dark colored surface layers. Included are similar soils with fewer subsoil rock fragments or with light colored surface layers. These soils occupy 95 percent of the unit.

Included are up to 5 percent dissimilar soils. Somewhat poorly drained soils occur in stream bottoms and are more productive range sites.

GENERAL DESCRIPTION The surface layer is dark grayish brown, silt loam about 8 inches thick. The subsoil is a calcareous or non-calcareous light yellowish brown, very cobbly silty clay loam about 14 inches thick. The substratum, a calcareous light yellowish brown, very cobbly loam or sandy loam, overlies bedrock at depths greater than 5 feet. See soil descriptions 10 and 13 for more detail.

CLASSIFICATION REMARKS The soils with moderately limey subsoils are Typic Argiborolls, loamy skeletal, mixed and Typic Haploborolls, loamy skeletal, mixed. The soils with very limey subsoils are Typic Calciborolls, loamy skeletal, carbonatic. Included similar soils are Typic Ustochrepts, loamy skeletal, mixed, frigid or Typic Argiborolls, fine loamy mixed.

The included dissimilar soils are Aquic Argiborolls or Argiaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces about 800 to 2,300 pounds per acre of air dry herbage in normal years. Soils with very limey subsoils in the Bridgers and northern Absaroka Beartooths have the lower potential productivity. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The included forest has understories which produce moderate amounts of forage. Following timber harvest, forage production increases and they are well suited for use as transitory range. In places, sagebrush control improves production of desirable forage plants. Lack of water may limit access to forage.

WILDLIFE-FISHERIES The unit is potentially fair fall mule deer and elk fall habitat. It is fair spring and summer blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

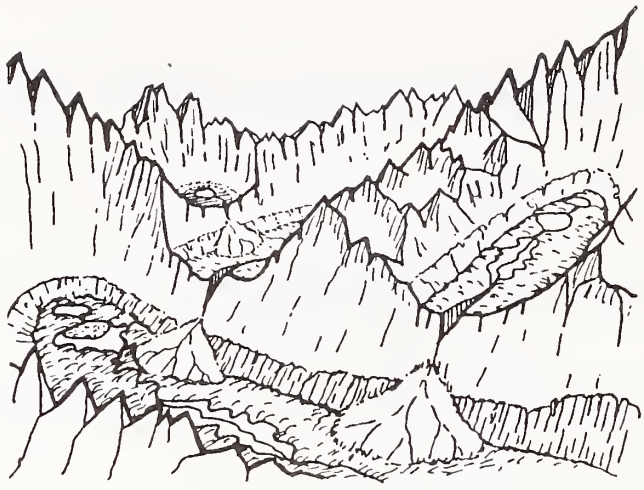
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	very low to low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	moderate
Grassland and shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 64-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level terraces, floodplains, and alluvial fans (center and lower left of the block diagram). Delineations occur throughout the survey area.

M.U. COMPONENTS Soils are moderately coarse to moderately fine textured with dark colored surface layers. They are formed in floodplain or glacial outwash deposits derived from a mixture of rock types. Native vegetation is mountain shrubland, mountain grassland, and open grown Douglas-fir or subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes with dense forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Southern	6,500-8,000	0

The unit consists of nearly level glacial outwash terraces and stream floodplains in valley bottoms. Included are some alluvial fans and stream terraces. These deposits are dissected by well defined perennial streams. There are occasional dry stream channels. The drainage system has a dendritic pattern with low channel gradients. These landforms often contain one major stream, and are subject to flooding after prolonged, high intensity storms. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID) or Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 55 percent; Douglas-fir HTs with shrub or bunchgrass understories - 30 percent. Included HTs with dissimilar management implications are subalpine fir HTs - 10 percent or riparian community types - 5 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID and FEID/AGSP occur in a mosaic throughout the unit. Douglas-fir HTs are included as similar. Warm, somewhat dry climates and moderately productive range sites are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. Subalpine fir HTs occur at higher elevations and are more productive as timber sites. Riparian communities occur along perennial streams and are more productive range sites.

EXISTING VEGETATION consists of mountain grasslands and shrublands with open grown Douglas-fir or subalpine fir forest. The grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbs. On more moist sites, sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are included. The forest has an understory dominated by low shrubs or grasses. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit contains glacial outwash and alluvial deposits - 100 percent.

The deposits are derived from a variety of rocks. They are Pleistocene or Holocene in age. These deposits are medium to moderately fine textured and contain numerous rounded cobbles and pebbles.

Included are some deposits with dissimilar properties. Deposits which contain few rock fragments are near low gradient streams or seeps. Soils formed in these deposits are more productive and have lower bearing strength.

SOILS

GENERAL NATURE OF SOILS Soils are well to moderately well drained, with moderately coarse to moderately fine textures. Subsoils contain 10-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains soils with dark colored surface layers. Where deposits are derived from hard crystalline rock, soils are moderately coarse textured and have little subsoil clay accumulation. Where deposits are derived from sandstone or shale, soils are medium to moderately fine textured with subsoil clay accumulations. Where deposits are derived from limestone, soils are medium textured with very limey subsoils. These soils occupy 80 percent of the unit.

Included are small areas of dissimilar soils. Soils with light colored surface layers are in forested areas and occupy 15 percent of the unit. They are more productive timber sites. Moderately well to poorly drained soils are on floodplains and occupy 5 percent of the unit. They are subject to frequent flooding and have lower bearing strength.

GENERAL DESCRIPTION The major soils have brown loam surface layers about 8 inches thick. Subsoils are pale brown, very gravelly clay loam, or sandy loam about 10 inches thick. The substratum, a light yellowish brown, very cobbly loam or sandy loam, overlies bedrock at depths greater than 5 feet. Soil descriptions 14 and 17 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The major soils are Cryoborolls. Argic Cryoborolls, loamy skeletal mixed; Argic Cryoborolls, fine loamy mixed; Typic Cryoborolls, loamy skeletal mixed and Calcic Cryoborolls, loamy skeletal mixed; are all families which have major representation in some delineations.

The included dissimilar soils with light colored surface layers are Mollic Cryoboralfs, loamy skeletal mixed. The seasonally wet soils are Argic Pachic Cryoborolls, loamy skeletal mixed and Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations. Roads which cross wet stream bottoms need suitable subgrade material because of low bearing strength.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,820 pounds per acre of dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Forested sites produce some forage and have good potential for use as transitory range. Sagebrush control improves production of desirable forage plants in places. Livestock tend to concentrate on stream bottoms.

WILDLIFE-FISHERIES This unit is potentially good fall and winter moose habitat. The unit is also potentially fair spring and summer grizzly bear habitat. Both species concentrate on the included moist or wet areas. Only major streams within the unit normally contain trout habitat.

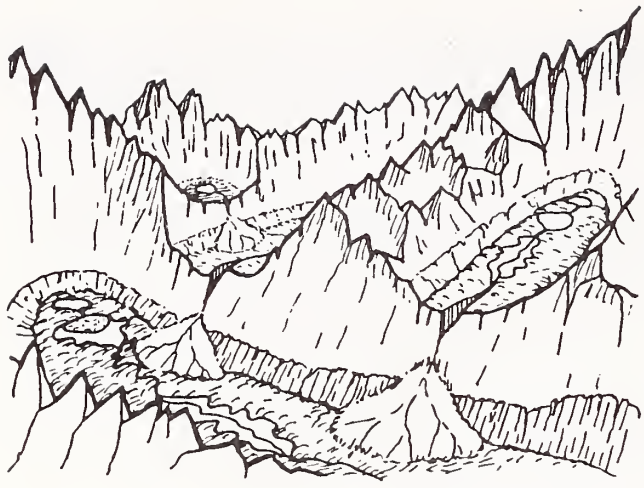
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	very low
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	high
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-June
Length of Frost Free Season (days)	50-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 64-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level, glacial outwash, alluvial floodplains, and alluvial fans (center and lower left of the block diagram). Delineations occur throughout the Forest.

M.U. COMPONENTS This unit contains an undifferentiated group of soils. Soils are moderately coarse to moderately fine textured with light and dark colored surface layers. They are formed in alluvial or glacial outwash deposits derived from a mixture of kinds of rocks. Native vegetation is dense lower subalpine forest, with some mountain meadows and riparian communities.

ADJOINING M.U. Adjacent units have steep slopes with dense forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Variable	6,000-7,000	0

The unit consists of nearly level glacial outwash terraces and stream floodplains in valley bottoms. Included are some alluvial fans and stream terraces. These deposits are dissected by well defined perennial streams. There are occasional dry stream channels. The drainage system has a dendritic pattern with low channel gradients. These landforms often contain one major stream, and are subject to flooding after prolonged, high intensity storms. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/grouse whortleberry (ABLA/VASC) - 40 percent and subalpine fir and Engleman spruce HTs with forb or shrub understory unions - 20 percent. Included HTs with dissimilar management implications are FEID/AGCA and Douglas-fir and subalpine fir forest with grassy understory unions - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/VASC occur at upper elevations. ABLA and PIEN HTs with understories dominated by forbs are found on wet soils at lower elevations. PSME and PICEA HTs with shrub understory unions are on drier sites at lower elevations. Cool, moist climates and high timber productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. FEID/AGCA and ABLA and PSME HTs with grass understories are in and around moist meadows. They are more productive range sites.

EXISTING VEGETATION consists of dense lodgepole pine and spruce forest on upper elevation slopes and Douglas-fir forest on lower elevation slopes. The forest understory is a dense mat of shrubs dominated by blue huckleberry and grouse whortleberry at upper elevations. At lower elevations, the taller shrubs, snowberry and ninebark are dominant. Near streams and seeps, the understories contain many forbs, dominated by baneberry, horsetail, sweet scented bedstraw and blue joint. In included moist mountain meadows, the vegetation is dominated by Idaho fescue and bearded wheatgrass. Pinegrass is the dominant understory plant in open canopied forests.

GEOLOGY

OCCURRENCE The unit contains glacial outwash and alluvial deposits - 100 percent.

These deposits are Pliestocene or Holocene in age. They are moderately coarse to moderately fine textured and contain numerous cobbles and pebbles.

Included are deposits with dissimilar properties. Deposits which contain fewer rock fragments occur on stream bottoms or near seeps. Soils formed in these deposits are more productive and have lower bearing strength.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat poorly drained, and have moderately coarse to moderately fine textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an undifferentiated group of soils with light and dark colored surface layers. Soils are highly variable in texture. In areas where the parent material is derived from hard crystalline rocks, soils are moderately coarse to medium textured. Where the parent material is derived from sandstone and shale, textures are medium to moderately fine. These soils occupy 70 percent of the unit.

Small areas of dissimilar soils are included. Somewhat poorly drained soils are on flood plains, in depressions, and on low terraces. They occupy 20 percent of the unit. They are more productive timber sites and have lower bearing strength. Also included are poorly drained soils that occur near streams and seeps. They have low bearing strength and flood periodically. They occupy 10 percent of the unit.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown, gravelly loam surface layers about 11 inches thick. Subsoils are pale brown, very cobbly silty clay loam, clay loam or sandy loam about 12 inches thick. The substratum, a very pale brown, very cobbly silty clay loam or sandy loam, overlies bedrock at depths greater than 5 feet. Soil description 4 is representative of some soils with light colored surface layers in this unit. Soils vary from one area to another.

The soils with dark colored surface layers have brown, loam surface layers about 8 inches thick. Subsoils are pale brown, very gravelly clay loam, silty clay loam, loam or sandy loam about 8 inches thick. The substratum, a light yellowish brown, very cobbly loam or sandy loam, overlies bedrock at depths greater than 5 feet. Soil description 17 is representative of some soils with dark colored surface layers in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Cryoborolls. Argic Cryoborolls, loamy skeletal, mixed is the most common soil family. Other families that may be present are Typic Cryoborolls, loamy skeletal, mixed; Argic Cryoborolls, fine loamy, mixed; and Argic Pachic Cryoborolls, loamy skeletal, mixed. The soils with light colored surface layers are Cryoboralfs. Typic Cryoboralfs, loamy skeletal, mixed are most common. Other families that may be present are Mollic Cryoboralfs, loamy skeletal, mixed and Typic Cryoboralfs, fine loamy mixed.

The included dissimilar somewhat poorly or poorly drained soils are Aquic Cryoboralfs, loamy skeletal, mixed and Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 65-97 cu. ft./acre. Equipment operation is moderately limited by frequent wet areas with low bearing strength. Under certain moisture conditions, compaction and rutting of the soil can occur. This limitation can be overcome by using vehicles only when the soil is dry or covered with snow. Windthrow can be a severe hazard.

ROADS The unit is moderately suited to road construction. Wet areas occur frequently, and are moderately difficult to avoid when locating roads. Suitable subgrade material and drainage design are required when crossing wet areas. Flooding and avalanches can damage roads. Care is required when constructing roads in and near stream channels to keep sediment from entering the channel system.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. Mountain meadows occupy 10 percent of the area but produce 80 percent of the forage. Location of forage in widely scattered areas limits accessibility. Forage production increases following timber harvest and the unit is well suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and moose habitat. Good summer grizzly bear habitat is also available. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Only major streams within the unit normally contain trout habitat.

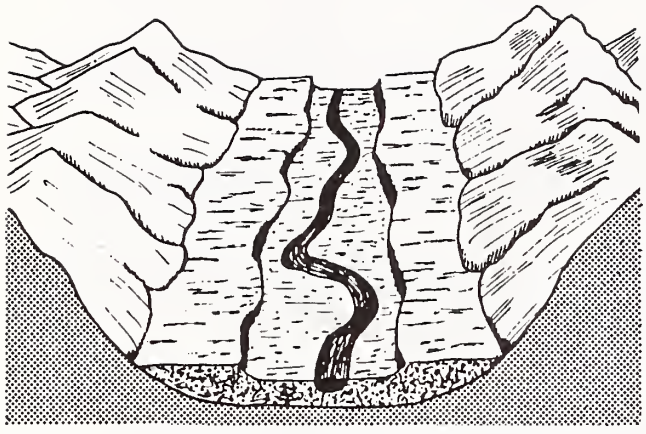
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate to high
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-25
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 66-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level stream floodplains and terraces (central portion of the block diagram). Delineations occur throughout the area.

M.U. COMPONENTS This unit contains an undifferentiated group of soils. Soils have variable textures and are seasonally or permanently wet. They are formed in recent alluvial deposits. Native vegetation is wet meadow and riparian communities.

ADJOINING M.U. Adjacent units have steep slopes with forested vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-10	Variable	6,600-8,600	0

The unit consists of nearly level terraces and floodplains. They contain stream channels, ponds, and bogs, and are dissected by well defined, large, perennial streams. The drainage system has a dendritic pattern with low channel gradients. These landforms are subject to frequent flooding. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of tufted hairgrass/sedge (DECA/CAREX) and willow communities - 90 percent. Included HTs with dissimilar management implications are forest and moist meadow HTs associated with better drained soils - 10 percent.

EXISTING VEGETATION consists of wet mountain meadows and willow with occassional forest or moist meadows. The wet meadows contain tufted hairgrass, timber oatgrass, timothy, rushes, and bentgrass.

HABITAT TYPE DISTRIBUTION DACA/CAREX and willow communities dominate the unit. Cool, very wet sites and highly productive range sites are associated with the HTs in this unit.

Included are up to 10 percent dissimilar HTs associated with better drained sites on benches and terraces. The moist meadows are less productive range sites and the forest HTs are most productive as timber sites.

GEOLOGY

OCCURRENCE The unit consists of recent alluvial deposits - 100 percent.

These deposits are derived from a variety of rock types. They are Holocene in age. Typically these deposits have variable textures and are seasonally or permanently wet.

Included are deposits having better drainage. They occur on benches and small knolls. They are less productive range sites but more productive timber sites.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat poorly to poorly drained, with variable textures. Subsoils contain 0 - 50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an undifferentiated group of somewhat poorly or poorly drained soils. Soils in this group have dark to light colored surface layers and variable textures. They occupy 90 percent of the unit.

Included are up to 10 percent dissimilar soils. Slightly better drained soils are on benches and knolls. They are either less productive range sites or more productive timber sites and have higher bearing strengths.

GENERAL DESCRIPTION The surface layer is light gray to very dark grayish brown silt loam about 15 inches thick. The subsoil is grayish brown, mottled with yellowish brown, sandy clay loam about 17 inches thick. The substratum, a gray, sandy clay loam, loam, or silt loam, overlies bedrock at depths greater than 5 feet. The water table fluctuates between depths of 0 and 20 inches. Soil descriptions 1 and 2 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Cryoquolls. The soils with light colored surface layers are Cryaquents.

The included dissimilar better drained soils are Argic Cryoborolls and Aquic Cryoboralfs.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is poorly suited to road construction. The high water table severely limits excavation. The base material has low bearing strength. Suitable subgrade material and drainage design are required when crossing wet areas. Care is required when constructing roads in and near stream channels to keep sediment from entering the channel system.

RANGE The unit is moderately suited to range mangement. Soils too wet to support grazing animals severely limit access to forage. Livestock trampling damages soils and vegetation when soils are wet. Livestock prefer these sites and tend to overutilize the vegetation before grazing adjacent uplands. The potential native plant community produces about 3,190 pounds per acre of air dry herbage in normal years. Timothy may have invaded these wet meadows. This may affect grazing season and utilization.

WILDLIFE-FISHERIES This unit is potentially good summer, fall, and winter moose habitat. It also is potentially good summer grizzly bear and elk habitat. Only major streams within the unit normally contain trout habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	low
Sediment Delivery Efficiency	moderate
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	high to very high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-50
Precipitation Distribution	variable
Average Winter Snow Depth (inches)	10-60+
Spring Runoff	April-June
Length of Frost Free Season (days)	50-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C, D

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the northern and southern Gallatin Range, Madison Range, north of Hebgen Lake, and northern Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of fine and moderately fine textured soils. They are formed in landslide deposits primarily from sandstone and shale. Native vegetation is dense, lower subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or drier subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,000-8,000	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with numerous seeps and ponds in depressions. These landforms have severe landslide hazards in more than 40 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts runoff into ponds and bogs.

Included are some structurally controlled sandstone ridges which are more stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/twinflower (ABLA/LIBO), subalpine fir/bluejoint (ABLA/CACA) and subalpine fir/sweetscented bedstraw (ABLA/GATR) - 45 percent and subalpine fir/blue huckleberry (ABLA/VAGL) - 30 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) - 15 percent and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION The major HTs ABLA/LIBO and ABLA/VAGL are on convex mounds and ABLA/GATR is in depressions. ABLA/CACA is usually found in or near seeps and springs. The similar included Engelmann spruce HTs with forb understory unions are associated with wetness. Cool climates and moderate timber productivity are associated with these HTs.

The dissimilar included HT FEID/AGCA is in moist meadows. ABLA-PIAL/VASC is at upper elevations. Both are less productive.

EXISTING VEGETATION consists of dense lodgepole pine forests with scattered mountain meadows. Engelmann spruce and subalpine fir forest occur in depressional positions or near seeps or springs. The forest understory is composed of twinflower or blue huckleberry on moderately well drained knobs; bane berry, twisted stalk, and sweetscented bedstraw in depressions; and blue joint in poorly drained locations near seeps and springs. The mountain meadows contain bearded wheatgrass, mountain bromegrass, timber oatgrass, and sticky geranium.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits and structural features associated with landslides - 100 percent.

The landslide deposits are formed primarily from interbedded shale, mudstone, siltstone, and some sandstone. These bedrocks are typically included in formations from the lower Cretaceous and Jurassic time periods. These deposits are fine textured, and contain few rock fragments. Some have a few large rounded hard crystalline boulders scattered on the surface.

SOILS

GENERAL NATURE OF SOILS. Soils are modrately well to somewhat poorly drained and moderately fine and fine textured, with subsoil clay accumulations. Subsoils contain 3-15 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of moderately well drained and somewhat poorly drained soils with fine and moderately fine textures. Soil properties vary with drainage and vegetation. Soils formed on forested mounds are moderately well drained. Included are similar soils with darker colored surface layers. They occupy 40 percent of the unit. Soils in forested depressions near seeps, springs, and small ponds are somewhat poorly drained. Water tables fluctuate seasonally from the soil surface to a depth of 14 inches in late summer. Included are similar soils where recent landslide movement has mixed the soil. They occupy 35 percent of the unit. These two soils occur as a mosaic within the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are small areas of dissimilar soils. Poorly drained meadow soils with dark colored surface layers occupy 15 percent of the unit. Moderately well drained soils at upper elevations occupy 10 percent of the unit. Both are less productive timber sites.

GENERAL DESCRIPTION Soil surface layers are very pale brown loams about 8 inches thick. Subsoils are light gray to yellowish brown clay loams or silty clay loams about 15 to 20 inches thick. Yellowish brown mottles are present in depressional areas. The substratum, a yellowish brown to gray brown clay loam to clay, overlies bedrock at depths greater than 5 feet. Soil descriptions 3 and 6 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The moderately well and somewhat poorly drained soils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs and Aquic Cryoboralfs. Mollic Cryoboralfs and Typic Cryochrepts are included.

The included poorly drained dissimilar soils are Argic Cryaquolls and Argiaquic Cryoborolls. The moderately well drained soils at upper elevations are Typic Cryochrepts and Argic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 65 - 97 cu. ft./acre. The forest helps to stabilize unstable slopes in this unit. Timber harvest can increase the risk of landslides. Equipment operation can compact or rut the soil. This limitation can be overcome by using vehicles only when the soil is snow covered or by using cable yarding systems.

ROADS The unit is poorly suited to road construction. Unstable slopes occur frequently. Slope stability should be evaluated before locating roads. Roads frequently need suitable subgrade material because of low strength and seasonal wetness. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. The included wet meadows occupy about 15 percent of the unit but produce 90 percent of the available forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose, and grizzly bear habitat. The unit also provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Streams and small lakes normally contain trout habitat.

INTERPRETATIONS

Landslide Hazards	high
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	----
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the southern Gallatin Range, southern Madison Range and west of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of moderately fine textured soils. They are formed in landslide deposits derived primarily from sandstone and shale. Native vegetation is mountain grassland and mountain shrubland with some Douglas-fir or lower subalpine forest.

ADJOINING M.U. Adjacent units have steeper slopes or forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
1-20	Variable	6,800-7,800	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement such as large cracks, slip scars, and lobate shaped deposits are present. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with numerous seeps and ponds in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have moderate landslide hazards on 20-40 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into ponds and bogs.

Included are some structurally controlled sandstone ridges which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 30 percent and big sagebrush/Idaho fescue (ARTR/FEID) - 30 percent; and subalpine fir (ABLA) HTs with grassy and shrubby understories - 20 percent. Included HTs with dissimilar management implications are Douglas-fir/snowberry (PSME/SYAL) - 15 percent; tufted hairgrass/sedges (DECA/CAREX) - 5 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the map unit. A similar HT, Idaho fescue/bearded wheatgrass (FEID/AGCA) is in depressional areas. The ABLA HTs occur in lodgepole pine forests at upper elevations. Warm moist climates and moderate range productivity are associated with the mountain grassland and shrubland HTs in this unit. Moderate timber productivity is associated with the ABLA HTs.

Included are up to 20 percent dissimilar HTs. PSME/SYAL is at lower elevations and has low timber productivity. This HT requires different silvicultural treatment than the ABLA HTs because of regeneration limitations. DECA/CAREX is in wet landscape positions and range productivity is high.

EXISTING VEGETATION consists of mountain grassland and shrubland with scattered stands of dense lodgepole pine forest. The grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbes. The shrubland has a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbes. On moist sites, sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are common. Douglas-fir seedlings are invading these mountain grasslands and shrublands in some areas.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits and structural features associated with landslides - 100 percent.

The landslides have developed in weathered bedrock and/or glacial till deposits. These deposits are composed of material derived from shale, mudstone, siltstone, and some sandstone. These bedrocks are included in formations from the Cretaceous and Jurassic time periods. Typically these landslide deposits are fine textured and contain few rock fragments. Some have a few hard crystalline boulders scattered on the surface.

SOILS

GENERAL NATURE OF SOILS Soils are well to moderately well drained, and moderately fine textured with subsoil clay accumulations. Subsoils contain 3-15 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with topographic position. Soils formed on mounds and benches have dark colored surface layers. Included are similar soils with light colored surface layers where recent landslide movement has mixed the soil. They occupy 50 percent of the unit. Soils formed in swales or other depressional positions have very thick dark colored surface layers. They occupy 30 percent of the unit. Soil textures are quite spatially variable because of the complexity of these landslide deposits.

Included are small areas of dissimilar soils. Soils with lighter colored surface layers are under forest vegetation. They occupy 15 percent of the unit and are less productive range sites. Poorly drained soils are in stream bottoms or wet meadows. They occupy 5 percent of the map unit and are more productive range sites.

GENERAL DESCRIPTION The soils with dark colored surface layers have brown silt loam or loam textured surface layers about 10 inches thick. The subsoil is light yellowish brown clay loam to clay with an occasional cobbly clay loam about 14 inches thick. The substratum, a light yellowish brown clay loam with variable rock fragment content, overlies bedrock at depths greater than 5 feet. Soil descriptions 16 and 17 are representative of some soils in this unit. Soils vary from one area to another.

The soils with very thick dark colored surface layers have grayish brown silt loam or loam textured surface layers about 18-20 inches thick. The subsoil is brown clay loam or cobbly clay loam (occasionally clay). The substratum, a yellowish brown clay loam, overlies bedrock at depths greater than 5 feet. Soil description 18 is representative of some soils with very thick dark colored surface layers in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The soils on mounds and benches are Argic Cryoborolls. The included similar soils are Typic Cryochrepts. The soils in swales are Argic Pachic Cryoborolls.

The included dissimilar soils are Mollic Cryoboralfs under forest and Argic Cryaquolls in poorly drained streamside areas and wet meadows.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production of the scattered subalpine forest stands is 52-68 cu. ft./acre. Competition slightly limits regeneration in these stands. Timber harvest can increase the risk of landslides. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation may be overcome by using equipment when soil is dry, covered with snow, or by using cable yarding harvest systems.

ROADS The unit is moderately suited to road construction. Unstable slopes are common. Slope stability should be evaluated before planning or locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Roads in wet areas need suitable subgrade material because of low bearing strength. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces from 1,634 to 2,338 pounds per acre of dry herbage in normal years. The soils with dark colored surface layers and the somewhat poorly drained meadow soils occupy 35 percent of the unit, but provide over 60 percent of the available forage. These soils are scattered throughout the unit in moist depressions and stream bottoms. Livestock prefer these areas which tends to concentrate grazing use. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Brush control increases forage production where big sagebrush is present.

WILDLIFE-FISHERIES This unit is potentially good fall and winter elk and mule deer habitat. Most delineations of this unit are within the winter range for the northern Yellowstone elk herd. It is potentially fair spring grizzly bear habitat. It is potenially fair spring blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-40
Spring Runoff	April-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-1C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the Madison Range, with some in the eastern Bridger Range, north of Hebgen Lake, and in the Cooke City area.

M.U. COMPONENTS This unit contains a complex of moderately fine textured soils. They are formed in landslide deposits derived primarily from sandstone and shale. Native vegetation is upper subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or lower subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,800-8,600	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present. Bedrock exposures are generally lacking but rubble is common throughout the unit. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with numerous seeps and ponds in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have severe landslide hazards on more than 40 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into ponds and bogs.

Included are some structurally controlled sandstone ridges which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 50 percent; subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/blue huckleberry (ABLA/VAGL) - 25 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and tufted hairgrass/sedge (DECA/CAREX) - 15 percent and subalpine fir/sweetscented bedstraw (ABLA/GATR) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC is at mid and upper elevations. ABLA/VAGL and ABLA/VASC are at lower elevations. Similar included HTs are whitebark pine - subalpine fir (PIAL-ABLA) at upper elevations, and subalpine fir/heartleaf Arnica (ABLA/ARCO) and subalpine fir/twinflower (ABLA/LIBO) at lower elevations. Cold climates and low timber productivity are associated with these HTs.

Included are up to 25 percent dissimilar HTs. FEID/AGCA and DECA/CAREX are in meadows scattered throughout the unit and are not forested. ABLA/GATR is in poorly drained locations at lower elevations. These areas are more productive timber sites.

EXISTING VEGETATION consists of moderately dense forest of stunted subalpine fir, whitebark pine and lodgepole pine with scattered mountain meadows. Forest canopies are open grown at upper elevations. The forest understory is a sparse to moderately dense mat of shrubs dominated by grouse whortleberry. Heartleaf Arnica and lupine are common. The mountain meadows contain bearded wheatgrass, mountain brome and timber oatgrass.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits and structural features associated with landslides - 100 percent.

The landslides have formed in weathered bedrock and/or glacial till deposits. These deposits are composed of material derived from shale, mudstone, siltstone, and some sandstone. These bedrocks are included in formations from the Cretaceous and Jurassic time periods. Typically these landslide deposits are fine textured and contain very few rock fragments. Some have a few large rounded hard crystalline rocks scattered on the surface.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well to somewhat poorly drained, and moderately fine textured with subsoil clay accumulations. Subsoils contain 3-15 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of moderately well and somewhat poorly drained soils with moderately fine textures. Soil properties vary with drainage and vegetation. Soils formed on forested mounds are moderately well drained. Included are similar soils with mixed soil layers. Soils in forested depressions near seeps, springs, and small ponds are somewhat poorly drained. Water tables fluctuate seasonally from the soil surface to a depth of 14 inches in late summer. These two soils occur as a mosaic within the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits. These soils occupy 75 percent of the unit.

Included are small areas of dissimilar soils. Moderately well drained meadow soils occupy 15 percent of the unit. Poorly drained meadow soils occupy 10 percent of the unit. Both soils are less productive timber sites.

GENERAL DESCRIPTION Soil surface layers are very pale brown loams about 8 inches thick. Subsoils are light grey to yellowish brown clay loams or silty clay loams about 15 to 20 inches thick. Yellowish brown mottles are present in depressional areas. The substratum, a yellowish brown to grey brown clay loam to clay, overlies bedrock at depths greater than 5 feet. Soil descriptions 3 and 6 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The moderately well drained soils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs, Aquic Cryoboralfs and Mollic Cryoboralfs. Included similar soils with mixed soil layers are Cryochrepts.

The included dissimilar soils are Argic Cryoborolls and Argic Pachic Cryoborolls in moderately well drained meadows. The poorly drained meadow soils are Argic Cryaquolls and Argiaquic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to commercial timber management. Potential annual production is 32-50 cu. ft./acre. The forest helps stabilize unstable slopes in this unit. Timber harvest can increase the risk of landslides. The unit is generally well suited to tractor operations. Under certain moisture conditions, equipment operation can compact or rut the soil. This limitation can be overcome by using equipment when soil is dry, covered with snow, or by using cable yarding systems.

ROADS The unit is poorly suited to road construction. Unstable slopes occur frequently. Slope stability should be evaluated before locating roads. Roads in wet areas need suitable subgrade material because of low strength. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill slope sloughing. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The included meadows occupy about 15 percent of the unit but provide 90 percent of the available forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. These forest sites are poorly suited for transitory range. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES This unit is potentially good summer and some fall elk, moose, and grizzly bear habitat. It is potentially good fall blue grouse habitat. Larger streams and small lakes in this unit normally contain trout habitat.

INTERPRETATIONS

Landslide Hazards	high
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	mderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-1D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineatons are mainly in the northern and southern Gallatin Range, northern Bridger Range, north of Hebgen Lake,

M.U. COMPONENTS This unit contains a complex of moderately coarse to moderately fine textured soils. They are formed in landslide deposits derived primarily from sandstone and shale. Native vegetation is dense, lower subalpine forest intermixed with meadows.

ADJOINING M.U. Adjacent units have steeper more rocky slopes or more dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
1-20	Variable	7,000-8,000	0

The unit consists of an irregular series of benches intermixed with some hummocky land surfaces. Bedrock exposures are lacking but rock rubble is common on prominent ridges. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with occasional seeps or ponds in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have moderate landslide hazards on less than 20 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into ponds and swales.

Included are some structurally controlled sandstone ridges which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/Pinegrass (ABLA/CARU), and subalpine fir/grouse whortleberry (ABLA/VASC) - 50 percent; Engelmann spruce/twin flower (PIEN/LIBO) - 15 percent; and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 15 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) - 10 percent and Douglas-fir/snowberry (PSME/SYAL) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/CARU is on southern and some western exposures. ABLA/VASC is on northern and eastern exposures with ABLA-PIAL/VASC at upper elevations. PIEN/LIBO is in depressions and near seeps. Similar HTs include subalpine fir/blue huckleberry (ABLA/VAGL) on northern exposures and subalpine fir/twinflower (ABLA/LIBO) in depressions. Cool moist climates and moderate timber productivity are associated with the HTs in this unit.

FEID/AGCA is in meadows. PSME/SYAL is at lower elevations and has moderate regeneration limitations.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered mountain meadows. Engelmann spruce forms a large part of the forest canopy in depressions. At upper elevations, whitebark pine and subalpine fir are codominant with lodgepole pine. The forest understory is composed of a thick mat of pinegrass on southern exposures and heartleaf arnica and grouse whortleberry on northern exposures. Twinflower is in depressional positions. Mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass, and sticky geranium.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits and structural features associated with landslides - 100 percent.

The landslides have developed in weathered bedrock and/or glacial till deposits. These deposits are composed of material derived from shale, mudstone, siltstone, and some sandstone. These bedrocks are included in formations from the Cretaceous and Jurassic time periods. Typically these landslide deposits are fine textured and contain few rock fragments. Some have a few hard crystalline boulders scattered on the surface.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine and moderately coarse textures. Subsoils contain 10 to 50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex of soils with moderately fine and moderately coarse textures. Soil properties vary with topographic position. Soils with moderately fine textures and light colored surface layers are on forested benches and in swales. Included are similar soils with thin dark colored surface layers. These soils occupy 40 percent of the unit. Soils with moderately coarse textures and light colored surface layers are on prominent ridges. They occupy 35 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are small areas of dissimilar soils. Soils with dark colored surface layers are in meadows and some forested areas. They occupy 20 percent of the unit and are less productive timber sites. Poorly drained soils are in depressional areas near seeps and springs. They occupy 5 percent of the unit and are more productive timber sites.

GENERAL DESCRIPTION The moderately fine textured soils have very pale brown gravelly loam surface layers about 11 inches thick. Soils are pale brown clay loam to cobbly clay loam about 20 inches thick. The substratum, a very pale brown clay loam or very cobbly clay loam, overlies bedrock at depths greater than 5 feet. Soil descriptions 3 and 4 are representative of some soils in this unit. Soils vary from one area to another.

The moderately coarse textured soils have brown, gravelly loam surface layers about 3 inches thick. The subsoils are pale brown to very pale brown, very cobbly sandy loam about 13 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies highly fractured bedrock at depths of about 5 feet. Soil description 21 is representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The moderately fine textured soils with light colored surface layers are Typic Cryoboralfs. The similar soils are Mollic Cryoboralfs. The moderately coarse textured soils are Typic Cryochrepts and are usually in loamy skeletal, mixed families.

The included dissimilar soils are Argic Cryoborolls or Argic Pachic Cryoborolls in fine loamy, mixed families; and Argic Cryaquolls, from fine, mixed families.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to commercial timber management. The potential annual production is 53-71 cu. ft./acre. The unit is generally well suited to tractor operation. The forest helps stabilize slopes. Timber harvest can increase the risk of landslides, locally. Regeneration is moderately limited by understory vegetation. Reduction of competing vegetation helps overcome this limitation.

ROADS The unit is moderately suited to road construction. Unstable slopes occur occasionally. Slope stability should be evaluated before locating roads. Roads crossing meadows need suitable subgrade material because of low strength and seasonal wetness. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The included meadows occupy 10 percent of the unit but provide 80 percent of the available forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little useable forage. Forage production increases after timber harvest. The unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk and moose habitat. It provides good summer grizzly bear habitat. Fair summer and fall mule deer habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-1E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the northern Gallatin Range, eastern Bridger Range, southern Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of soils with dark colored and somewhat dark colored surface layers. They are formed in landslide deposits derived primarily from sandstone and shale. Native vegetation is Douglas-fir and subalpine fir forest intermixed with mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or have grassland or subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Southern	6,700-7,500	0

The unit consists of an irregular series of benches intermixed with some hummocky land surfaces. Bedrock outcrops are lacking but rock rubble is common on prominent ridges. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with occasional seeps in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have moderate landslide hazards in less than 20 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into seeps and swales.

Included are some structurally controlled sandstone ridges which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/blue huckleberry (PSME/VAGL) and Douglas-fir/snowberry (PSME/SYAL) - 45 percent; subalpine fir/blue huckleberry (ABLA/VAGL) - 30 percent. Included HTs with dissimilar management implications are Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 15 percent; Douglas-fir and limber pine with grassy understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION PSME/VAGL and PSME/SYAL are at lower elevations or on southern exposures. Included similar HTs are Douglas-fir/ninebark (PSME/PHMA), Douglas-fir/white spirea (PSME/SPBE), Engelmann spruce (PIEN) with forb and shrub understory unions and subalpine fir/pinegrass (ABLA/CARU). Warm, moist climates and moderate timber productivity are associated with these HTs. ABLA/VAGL is at upper elevations and includes the similar subalpine fir/grouse whortleberry (ABLA/VASC) HT. Cool climates and moderate timber productivity are associated with these HTs.

Included are small areas of dissimilar HTs. FEID/AGSP is at lower elevations or on southern exposures, and may include some big sagebrush (ARTR) HTs. Douglas-fir and limber pine HTs with grassy understories are often adjacent to these mountain grasslands. Warm, dry climates are associated with these non-timbered or sparsely timbered HTs.

EXISTING VEGETATION consists of open grown to dense Douglas-fir and lodgepole pine forest with scattered mountain grasslands. The forest understory is composed of a moderately thick stand of shrubs dominated by snowberry and blue huckleberry. Bunchgrass and pinegrass are common. The mountain grasslands are dominated by Idaho fescue, bluebunch wheatgrass and common forbs. Some are being invaded by Douglas-fir seedlings.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits and structural features associated with landslides - 100 percent.

The landslides have developed in weathered bedrock and/or glacial till deposits. These deposits are composed of material derived from shale, mudstone, siltstone, and some sandstone. These bedrocks are typically included in formations from the Cretaceous and Jurassic time periods. Typically these landslide deposits are fine textured and contain few rock fragments. Some have a few hard crystalline boulders scattered on the surface.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine to fine textures. Subsoils contain 3-20 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex pattern of soils. Soil properties vary with vegetative patterns. Soils formed in mountain grasslands or sparsely forested areas have dark colored surface layers. These soils occupy 45 percent of the unit. Soils under dense forests have thin dark colored surface layers. Included similar soils have light colored surface layers. These soils occupy 30 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are small areas of dissimilar medium textured soils with either dark or light colored surface layers. These soils are in grasslands, near ridges or near rock rubble and occupy 25 percent of the unit. They are less productive range sites.

GENERAL DESCRIPTION The grassland and sparsely forested soils have brown silt loam to loam textured surface layers about 8 inches thick. Subsoils are light yellowish brown clay loam about 13 inches thick. The substratum, a light yellowish brown clay loam to clay, overlies bedrock at depths greater than 5 feet. Soil description 15 is representative of some of these soils in this unit. Soils vary from one area to another.

The densely forested soils have light brownish gray loam surface layers about 6 inches thick. Subsoils are light yellowish brown clay loam or cobbly clay loam about 22 inches thick. The substratum, a pale brown clay loam to cobbly clay loam, overlies bedrock at depths greater than 5 feet. Soil description 4 is representative of some forested soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The grassland and sparsely forested soils are Argic Cryoborolls. The densely forested soils are Mollic Cryoboralfs. Similar soils are Typic Cryoboralfs.

The included dissimilar soils are Typic Haploborolls and Typic Cryochrepts.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to commercial timber management. The potential annual production is 54-76 cu. ft./acre. The unit is generally well suited to tractor operation. Locally, the forest helps stabilize unstable slopes. Timber harvest may increase the risk of landslides. Regeneration is moderately limited by moisture stress and understory competition. Timely site preparation helps to overcome this limitation

ROADS The unit is moderately suited to road construction. The unstable slopes occur occasoinally. Slope stability should be evaluated before locating roads. Roads need suitable subgrade material because of the low strength and seasonal wetness. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The forest understory produces little useable forage. Mountain grasslands occupy 15 percent of the unit but provide over 50 percent of the available forage. The location of forage in scattered areas limits accessibility. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer and fall elk habitat. It also provides good fall blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the Gallatin Range with some in the western Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of moderately well and somewhat poorly drained soils. Soils are fine and moderately fine textured. They are formed in landslide deposits derived primarily from volcanic bedrock. Native vegetation is dense, moist lower subalpine forest intermixed with some mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or drier subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
1-20	Variable	7,000-8,000	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present in areas where moisture is concentrated. Bedrock expcsures are generally lacking but rock rubble occurs locally on prominent ridgetops. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with a few seeps and small lakes in depressions. These landforms have severe stability hazards in 20-40 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into ponds and bogs.

Included are some structurally controlled ridges, supported by competent volcanic bedrock, which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/twinflower (ABLA/LIBO), subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/grouse whortleberry (ABLA/VASC) - 75 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) and several subalpine fir and Engelmann spruce HTs associated with seasonally high water tables - 20 percent; and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA/LIBO and ABLA/VAGL are on benches and mounds. Moss covers much of the forest litter in these HTs. ABLA/VASC is on knobs and prominent ridges. Cool climates and moderate timber productivity are associated with these HTs. In this unit, soils in these HTs are seasonally wet.

Included are small areas of dissimilar HTs. Subalpine fir (ABLA) and Englemann spruce (PIEN) with water loving understory unions are in somewhat poorly drained depressions and near streams, seeps, and springs. The fir and spruce HTs are more productive timber sites. ABLA-PIAL/VASC is at upper elevations and is on less productive timber sites. FEID/AGCA is in meadows.

EXISTING VEGETATION consists of dense stands of lodgepole pine forest and some mountain meadows. Engelmann spruce, and occasionally subalpine fir forest occur in depressions or near seeps and springs. The forest understory is a thick mat of low shrubs. Twinflower or blue huckleberry are on moderately well drained benches, grouse whortleberry is on knobs and prominent ridges. Baneberry, twisted stalk, sweet scented bedstraw and common horsetail are in poorly drained depressions, and bluejoint is in poorly drained locations near seeps and springs. The mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits - 100 percent.

These landslide deposits have formed in material weathered from volcanic rocks of Tertiary age or glacial till deposits. They are moderately fine textured with variable amounts of cobbles and gravels.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well and somewhat poorly drained with moderately fine textures and subsoil clay accumulations. Subsoils contain 10 to 50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of moderately well drained and somewhat poorly drained soils. Soil properties vary with drainage and vegetation. Soils formed on moderately well drained forested mounds have light colored surface layers. Included similar soils have thin dark colored surface layers. Somewhat poorly drained soils occur in meadows, depressions, and near seeps, springs, and small lakes. These soils have thin dark colored surface layers. These soils occupy 90 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits. Mixing sometimes occurs which results in destruction of the clay accumulation layer.

Included are up to 10 percent dissimilar soils. These soils are also somewht poorly drained but are in mountain meadows. They have thick dark colored surface layers.

GENERAL DESCRIPTION The moderately well drained soils have very pale brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown clay loams with some cobbly clay loams about 23 inches thick. The substratum, a light yellowish brown clay loam, overlies bedrock at depths greater than 5 feet. Soil description 3 is representative of some soils in this unit. Soils vary from one area to another.

The somewhat poorly drained forested soils have light brownish gray loam surface layers about 7 inches thick. Subsoils are light gray clay loams with yellowish brown mottles about 15 inches thick. The substratum, a grayish brown clay loam with yellowish brown mottles, overlies bedrock at depths greater than 5 feet. Soil description 5 is representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The moderately well and somewhat poorly drained soils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs, Mollic Cryoboralfs and Aquic Cryoboralfs. Included similar soils in recent landslides are Typic Cryochrepts.

The dissimilar included meadow soils are Argic Pachic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. Potential annual production is 66-86 cu. ft./acre. The unit is generally well suited to tractor operation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides. Equipment operation can compact or rut the soil. This limitation can be overcome by using equipment when soil is covered with snow or by using cable yarding systems.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before locating roads. Roads need suitable subgrade material because of the low strength and seasonal wetness. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The included somewhat poorly drained meadows ocupy 10 percent of the unit but provide 90 percent of the available forage. Location of forage in scattered areas limits accessibility. The forest understory produces little forage. These forest sites are poorly suited for transitory range. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, grizzly bear, and moose habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Larger streams and small lakes in the unit contain trout habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	none
Forest Understory Forage Productivity	moderate
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the Gallatin Range with some in the Gardiner area of the Absaroka-Beartooth Range and in the northwestern Crazy Mountains.

M.U. COMPONENTS This unit contains a complex of soils with light colored and thin dark colored surface layers. Soils are moderately fine textured. They are formed in landslide deposits derived primarily from volcanic bedrock. Native vegetation is dense lower subalpine forest intermixed with mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or more moist subalpine fir forests vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
1-20	Variable	7,000-8,200	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present in isolated areas where moisture is concentrated. These areas are often in poorly established stream drainages or near seeps. Bedrock exposures are generally lacking but rock rubble can occur on prominent ridges. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with a few seeps in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have scattered slope stability hazards on less than 20 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into depressions.

Included are some structurally controlled ridges, supported by competent volcanic rocks, which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry, (ABLA/VAGL) and subalpine fir/pine grass (ABLA/CARU) - 75 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) - 15 percent and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL occur throughout the unit. ABLA/CARU is on southern exposures. Included similar HTs are subalpine fir/heartleaf Arnica (ABLA/LIBO). Cool moist climates and moderate timber productivity are associated with these HTs.

Included are up to 25 percent dissimilar HTs. FEID/AGCA occupies scattered moist mountain meadows. ABLA-PIAL/VASC is at upper elevations on less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest with scattered mountain grassland. The forest understory is composed of a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry on northern exposures. Pinegrass is dominant on southern exposures. The mountain meadows are characterized by tall grasses. Bearded wheatgrass mountain brome, timber oatgrass and the forb sticky geranium are common.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits - 100 percent.

These landslide deposits have formed in material weathered from volcanic rocks of Tertiary age or glacial till deposits. They are moderately fine textured with variable amounts of cobbles and gravels.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures and subsoil clay accumulations. Subsoils contain 15-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soils formed under dense subalpine forests have light colored surface layers. Similar soils have thin dark colored surface layers. These soils are not obviously associated with landscape features. They occupy 85 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are small areas of dissimilar soils with thick dark colored surface layers. These soils are in mountain grasslands. They occupy 15 percent of the unit.

GENERAL DESCRIPTION The soils with light colored surface layers have pinkish gray, loam or gravelly loam surface layers about 9 inches thck. The subsoil is reddish brown, clay loam or cobbly clay loam about 23 inches thick. The substratum, a reddish brown gravelly clay loam or very cobbly clay loam, overlies bedrock at depths greater than 5 feet. Soil description 3 is representative of some soils in this unit. Soils vary from one area to another.

The soils with thin dark colored surface layers have light brownish gray loam or gravelly loam surface layers about 14 inches thick. The subsoils are light yellowish brown gravelly clay loams or cobbly clay loams abuot 22 inches thick. The substratum, a reddish brown gravelly clay loam or very cobbly clay loam, overlies bedrock at depths greater than 5 feet. Soil description 6 is representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The forested soils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs and Mollic Cryoboralfs.

The included dissimilar mountain meadow soils are Argic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to commercial timber management. The potential annual production is 53-71 cu. ft./acre. The unit is genarally well suited to tractor operations. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides in some areas. Regeneration is slightly limited by competition. Reducing competing vegetation overcomes this limitation.

ROADS The unit is well suited to road construction. Unstable slopes occur in some areas. Slope stability should be evaluated before locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is moderately suited to range management. The included meadows occupy 15 percent of the unit but provide 90 percent of the available forage. The location of forage in widely scattered areas limits availability. The forest understory produces little forage. Forage production increases following timber harvest and the unit is moderately suited for use as transitory range. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES This unit is potentially fair summer elk and mule deer habitat. Good summer grizzly bear habitat is also available. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Streams within the unit normally contain trout habitat. The unit also frequently borders streams containing suitable habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the Gallatin Range.

M.U. COMPONENTS This unit contains a complex of soils. Soils are moderately fine textured. They are formed in landslide deposits derived primarily from volcanic bedrock. Native vegetation is upper subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have steeper slopes or lower subalpine fir forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	7,800-8,500	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement, such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present in areas where moisture is concentrated. Bedrock outcrops are generally lacking, but rock rubble can occur on prominent ridges. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with seeps and ponds in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into depressions and ponds.

Included are some structurally controlled ridges, supported by competent volcanic rocks, which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 55 percent; and subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/blue huckleberry (ABLA/VAGL) - 30 percent. An included HT with dissimilar management implications is Idaho fescue/bearded wheatgrass (FEID/AGCA) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC is at mid and upper elevations. A similar included HT is whitebark pine-subalpine fir (ABLA/PIAL) at upper elevations. Cold climates and low timber productivity are associated with these HTs. ABLA/VASC and ABLA/VAGL are at lower elevations. Subalpine fir/twinflower is a similar HT in moist areas. Cool moist climates and moderate timber productivity are associated with these HTs.

Included is up to 15 percent of the dissimilar HT FEID/AGCA in moist mountain meadows. Cool seasonally wet conditions are associated with these meadows.

EXISTING VEGETATION consists of stunted, moderately dense, lodgepole pine and whitebark pine forests with some subalpine fir and Engelmann spruce. Forest canopies are more open at upper elevations. The forest understory is composed of a sparce mat of shrubs dominated by grouse whortleberry, heartleaf Arnica and lupine. The mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits - 100 percent.

These landslide deposits have formed in material weathered from volcanic rocks of Tertiary age or glacial till deposits. They are moderately fine textured with variable amounts of cobbles and gravels.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well drained, with moderately fine textures and subsoil clay accumulations. Subsoils contain 10-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils formed under dense subalpine forests have light colored surface layers. Similar soils have thin dark colored surface layers. They occupy 55 percent of the unit. Soils in meadows or under open grown forests have dark colored surface lyaers. They occupy 30 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are small areas of somewhat poorly drained meadow soils. They occupy 15 percent of the unit and are less stable.

GENERAL DESCRIPTION The soils under dense forest have very pale brown loam surface layers about 9 inches thick. Subsoils are yellowish brown clay loams with some cobbly clay loams about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil description 3 is representative of some soils in this unit. Soils vary from one area to another.

The meadow or open canopied forest soils have grayish brown silt loam surface layers about 12 inches thick. Subsoils are light yellowish brown to brown clay loam with some cobbly clay loam about 15 inches thick. The substratum, a yellowish brown gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil descriptions 16 and 18 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The densely forested soils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs and Mollic Cryoboralfs. The meadow or open grown forest soils are Cryoborolls. The most common subgroup in meadows is Argic Pachic Cryoborolls. Argic Cryoborolls are often under open grown forests.

The included somewhat poorly drained dissimilar soils are Agric Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 32-71 cu. ft./acre. Trees are stunted, poorly formed, or have spiral grain. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides. Regeneration is moderately limited by harsh subalpine climates. This limitation is difficult to overcome.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. The included meadows occupy 15 percent of the unit but provide 90 percent of the available forage. The location of forage in widely scattered are as limits availability. The forest understory produces little useable forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose, and grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. Large streams and small lakes in this unit normally contain trout habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productiivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-50
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 71-20

MAP UNIT SUMMARY

M.U. SETTING The landform consists of a hummocky land surface (block diagram). Delineations are mainly in the Gallatin Range, southwestern Absaroka-Beartooth Range, and western Crazy Mountains.

M.U. COMPONENTS This unit contains a complex of soils. Soils are moderately fine textured. They are formed in landslide deposits derived primarily from volcanic bedrock. Native vegetation is mountain grassland and Douglas-fir forest.

ADJOINING M.U. Adjacent units have steeper slopes or have a vegetative cover entirely of grassland or forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Southern	6,800-7,800	0

The unit consists of hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement, such as large cracks, leaning trees, slip scars, and lobate shaped deposits are present in isolated areas where moisture is concentrated. These areas are often in poorly established stream drainages or near seeps. These slopes are dissected by poorly defined streams. The drainage system has a deranged or irregular pattern with a few seeps in depressions. Where streams have well defined channels, the banks are nearly vertical. These landforms have scattered slope stability hazards on less than 20 percent of the unit. They have high subsurface water storage capacity and the deranged drainage system diverts surface runoff into depressions.

Included are some structurally controlled ridges, supported by competent volcanic rock, which are stable.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of big sagebrush/Idaho fescue (ARTR/FEID) and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 60 percent; and Douglas-fir/blue huckleberry (PSME/VAGL) and Douglas-fir/snowberry (PSME/SYAL) - 30 percent. An included HT with dissimilar management implications is subalpine fir/twinflower (ABLA/LIBO) - 10 percent.

HABITAT TYPE DISTRIBUTION ARTR/FEID and FEID/AGSP occur in a mosaic throughout the unit. Included similar HTs are open grown limber pine (PIFL) and Douglas-fir forests with grassy understory unions. Warm, dry climates and moderate range productivities are associated with these HTs. PSME/VAGL and PSME/SYAL occur as small forest stands scattered throughout the unit. A similar included HT is Douglas-fir/ninebark (PSME/PHMA). Warm, moist climates and moderate range productivity are associated with these HTs.

Included are small areas of the dissimilar HT subalpine fir/twinflower (ABLA/LIBO) at upper elevations. Cool moist climates and more productive timber sites are associated with this HT.

EXISTING VEGETATION consists of mountain grassland and mountain shrubland with scattered stands of dense Douglas-fir forest. Where big sagebrush is present, the understory is dominated by Idaho fescue and common forbes. The grasslands are dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbes. On moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are common. Douglas-fir seedlings are invading some mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit consists of landslide deposits - 100 percent.

These landslide deposits have formed in material weathered from volcanic rocks of Tertiary age or glacial till deposits. They are moderately fine textured with variable amounts of cobbles and gravels.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures and subsoil clay accumulations. Subsoils contain 10-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils in mountain grasslands and shrublands have dark colored surface layers. They occupy 60 percent of the unit. Soils under dense forest have thin dark colored surface layers. They occupy 30 percent of the unit. The occurrence of many soil properties is variable because of the complexity of these landslide deposits.

Included are up to 10 percent dissimilar soils with thick dark colored surface layers. These soils are in swales and near seeps. They are more productive range sites.

GENERAL DESCRIPTION The mountain grassland and shrubland soils have dark grayish brown, silt loam surface layers about 8 inches thick. Subsoils are dark brown clay loam or cobbly clay loam about 15 inches thick. The substratum, a dark brown gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil description 16 is representative of some soils in this unit. Soils vary from one area to another.

The soils under Douglas-fir forest have thin, dark grayish brown loam surfaces about 6 inches thick. Subsoils are reddish brown, clay loam or cobbly clay loam about 22 inches thick. The substratum, a reddish brown gravelly clay loam or very cobbly clay loam, overlies bedrock at depths greater than 5 feet. See Soil description 6 is representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS Soils under mountain grassland and shrubland are Argic Cryoborolls. Soils under Douglas-fir forest are Mollic Cryoboralfs. The included dissimilar soils are Argic Pachic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production of the forested areas is 47 to 75 cu. ft./acre. Forest regeneration is moderately limited by moisture stress and competition. Natural regeneration can be limited to years when seed production is good and precipitation is above average. Shelterwood or group selection silvicultural systems, site preparation and planting help improve regeneration success. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides in some areas.

ROADS The unit is well suited to road construction. Unstable slopes occur occasionally. Slope stability should be evaluated before planning or locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures helps overcome this limitation.

RANGE The unit is well suited to range management. The potential native grassland and shrubland plant communities produce 1634 to 1,820 pounds per acre of air dry herbage in normal years. Seeps and swales are favored by livestock and they tend to concentrate in these areas. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Sagebrush control improves production and the accessibility of forage in some areas.

WILDLIFE-FISHERIES This unit is potentially good fall and winter elk and mule deer habitat. Good summer blue grouse habitat is also available. The unit does not normally contain trout habitat but borders streams that do.

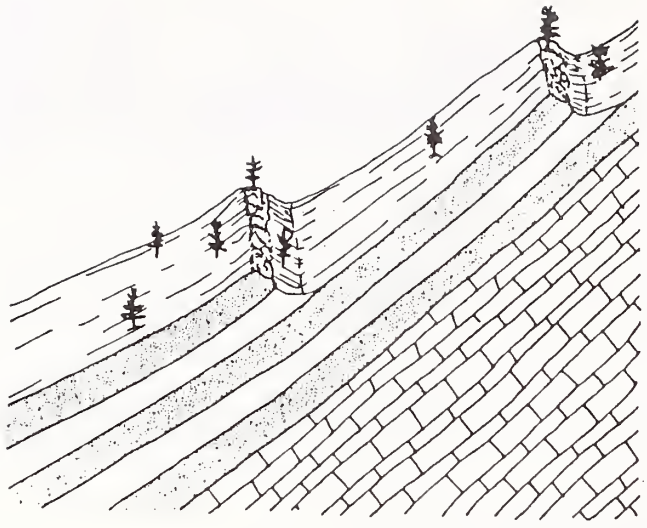
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-40
Spring Runoff	March-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 82-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping, structurally controlled slopes (dipslopes) (block diagram). The slope of the land surface is determined by the dip of the underlying rocks. Delineations are mainly in the northern Gallatin Range, northern Bridger Range, southern Madison Range, and northern Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of soils. They are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is dense lower subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have slopes where the dip of the underlying bedrock does not determine the slope of the land surface.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-20	Northern	7,000-8,000	5

The unit consists of long, gently sloping, smooth linear slopes that generally conform to the dip of the underlying interbedded bedrock (dipslope). These landforms have the appearance of a large flat bench that has been tilted up at one end. Normally these surfaces are wider at their base and gradually taper upward. Landslide deposits occur locally where moisture is concentrated. These hummocky deposits are near streams, large seeps, or in small draws. Bedrock outcrops occur along the margins of the unit. These landforms are dissected by poorly defined, perennial streams. The drainage system has a trellis pattern with moderate channel gradients. These landforms have moderate landslide hazards. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/blue huckleberry (ABLA/VAGL) - 50 percent, and subalpine fir/twinflower (ABLA/LIBO) - 20 percent. Included HTs with dissimilar management implications are Douglas-fir/snowberry (PSME/SYAL) - 10 percent; Engelmann spruce (PIEN) HTs with forb understory unions - 10 percent; and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 5 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC and ABLA/VAGL are on well drained sites and ABLA/LIBO is in moderately well drained depressions and stream bottoms. Included similar HTs are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) at higher, and subalpine fir/pinegrass (ABLA/CARU) or subalpine fir/heartleaf Arnica (ABLA/ARCO) at lower elevations. Cool, moist climates and moderate timber productivity are associated with these HTs in this unit.

Included are up to 25 percent dissimilar HTs. PSME/SYAL occurs at lower elevations and requires different silvicultural treatment because of regeneration limitations. Spruce HTs occur on moist sites and are more productive timber sites. FEID/AGCA occurs in moist meadows and is a range site.

EXISTING VEGETATION consists of dense lodgepole pine forests with scattered mountain meadows. Engelmann spruce and subalpine fir forests are in moist depressions or along stream bottoms. The forest understory contains low shrubs, dominantly blue huckleberry, grouse whortleberry and twinflower. The moist mountain meadows contain bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium. Big sagebrush is often present.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, mudstone, siltstone, and sandstone - 100 percent.

The interbedded bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. Slope of the land surface conforms approximately to bedrock dip. The bedrock is upper Cretaceous through Trassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group.

Included bedrock with dissimilar properties is light colored quarzitic sandstone of the Quandrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well to well drained, with moderately fine textures. Subsoils contain 15-35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils with light colored surface layers and thin dark colored surface layers. The soils are not obviously associated with landscape features, but soils with thin, dark colored surface layers are more common near meadows. Included are similar soils with subsoils containing 35-50 percent rock fragments. These soils occupy 70 percent of the unit.

Included are up to 25 percent dissimilar soils. Poorly drained soils are in depressions or stream bottoms, and are more productive timber sites. Soils with thick dark colored surface layers are in meadows. Moderately coarse textured soils occur in areas underlain by hard sandstone, and are less productive timber sites.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown, loam surface layers about 9 inches thick. Subsoils are yellowish brown gravelly clay loam about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of greater than 5 feet. Soil color is variable because of variable parent material color. See soil description 3 for more detail.

The soils with thin dark colored surface layers have light brownish gray, loam surface layers about 14 inches thick. Subsoils are light yellowish brown gravelly clay loam about 22 inches thick. The substratum, a pale brown gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil color is variable because of variable parent material color. See soil description 6 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. The soils with thin, dark colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Included as similar are Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar poorly drained soils are Aquic Cryoboralfs, fine loamy, mixed. Argic Cryoborolls, fine loamy, mixed are in meadows and Typic Cryochrepts, loamy skeletal, mixed overlie hard sandstone.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 52-70 cu. ft./acre. Slope steepness limits equipment operation in some areas. Under certain moisture conditions, equipment operation may compact or rut the soil. Operating equipment only when the soil is dry or covered with snow helps overcome this limitation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before planning or locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE This unit is poorly suited to range management. The included moist mountain meadows occupy about 5 percent of the unit but provide 90 percent of the available forage. The location of forage in widely scattered meadows limits accessibility. The forest understory produces little forage. Following timber harvest forage production increases. The unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall moose and summer elk habitat. It is potentially fair summer grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. The unit does not normally contain trout habitat but borders streams that do.

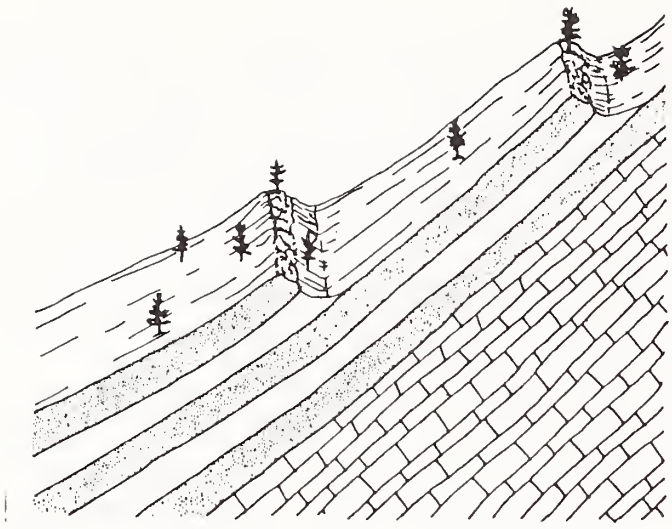
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 82-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping, structurally controlled slopes (dipslopes) (block diagram). The slope of the land surface is determined by the dip of the underlying rocks. Delineations are mainly in the southern Madison range with some west and north of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of soils. They are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is upper subalpine forest intermixed with some mountain meadows.

ADJCINING M.U. Adjacent units have slopes where the dip of the underlying bedrock does not determine the slope of the land surface.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-20	Northern	8,000-8,800	5

The unit consists of long, gently sloping smooth linear slopes that generally conform to the dip of the underlying interbedded bedrock (dipslope). These landforms have the appearance of a large flat bench that has been tilted up at one end. Normally these surfaces are wider at their base and gradually taper upward. Landslide deposits occur locally where moisture is concentrated. These hummocky deposits are near streams and large seeps, or in small draws. Bedrock outcrops occur along the margins of the unit. These landforms are dissected by poorly defined, perennial streams. The drainage system has a trellis pattern with moderate channel gradients. These landforms have moderate landslide hazards. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 70 percent; and subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/heartleaf arnica (ABLA/ARCO) - 15 percent. An included HT with dissimilar management implications is Idaho fescue/bearded wheatgrass (FEID/AGCA) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC occurs at mid to higher elevations. ABLA/VASC and ABLA/ARCO occur at lower elevations. Whitebark pine-subalpine fir (PIAL-ABLA) is an included similar HT at the highest elevations. Cold climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. FEID/AGCA occurs in meadows and is a range site.

EXISTING VEGETATION consists of forests of stunted lodgepole pine, whitebark pine subalpine fir and Engelmann spruce with scattered mountain meadows. Forests are dense on lower slopes and open grown on upper slopes and ridges. The forest understory is a somewhat sparse mat of low shrubs and forbs dominated by grouse whortleberry, heartleaf arnica and lupine. The meadows contain bearded wheatgrass, mountain brome, and timber oatgrass.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, mudstone, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. The slope of the land surface conforms approximately to bedrock dip. The bedrock is lower Cretaceous through Triassic in age. The most common geologic formations are Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quandrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well to somewhat poorly drained, and moderately fine textured with light colored surface layers and subsoil clay accumulations. Subsoils contain 15-35 percent flat, angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of moderately well and somewhat poorly drained soils. Moderately well drained soils occupy 55 percent of the unit and somewhat poorly drained soils 30 percent. The soils are not obviously associated with landscape features. Included similar moderately well drained soils have thin dark colored surface layers. Other similar soils throughout the unit have more subsoil rock fragments.

Small areas of dissimilar soils are included. Soils with thick, dark colored surface layers are in meadows and occupy 10 percent of the unit.

GENERAL DESCRIPTION The moderately well drained soils have very pale brown, loam surface layers about 9 inches thick. Subsoils are yellowish brown, gravelly clay loam about 23 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths of more than 5 feet. See soil description 3 for more detail.

The somewhat poorly drained soils have light brownish gray, silt loam or loam surface layers about 7 inches thick. Subsoils are light gray mottled with yellowish brown, sandy clay loam, clay loam or silty clay loam about 15 inches thick. The substratum, a grayish brown mottled with yellowish brown, gravelly clay loam, overlies bedrock at depths of more than 5 feet. A fluctuating water table occurs at depths ranging from 18 to 30 inches. See soil description 5 for more detail.

CLASSIFICATION REMARKS The moderately well drained soils are Typic Cryoboralfs fine loamy, mixed. The somewhat poorly drained soils are Aquic Cryoboralfs, fine loamy, mixed. Included similar moderately well drained soils are Mollic Cryoboralfs, fine loamy, mixed, and Typic Cryoboralfs, loamy skeletal, mixed. Included similar somewhat poorly drained soils are Aquic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils with thick dark colored surface layers are Argic Pachic Cryoborolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 32-50 cu. ft./acre. Harsh subalpine climate moderately limits regeneration. Trees are stunted, poorly formed, or have spiral grain. The forest helps to stabilize unstable slopes. Timber harvest may increase the risk of landslides.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before planning or locating roads. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. The included moist mountain meadows occupy about 10 percent of the unit but produces 90 percent of the available forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little useable forage. The forest understory is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good summer and fall moose and grizzly bear and summer elk habitat. The unit does not normally contain trout habitat but borders streams that do. If soil erosion or landslides occur, they are a potential source of sediment which can damage fish habitat.

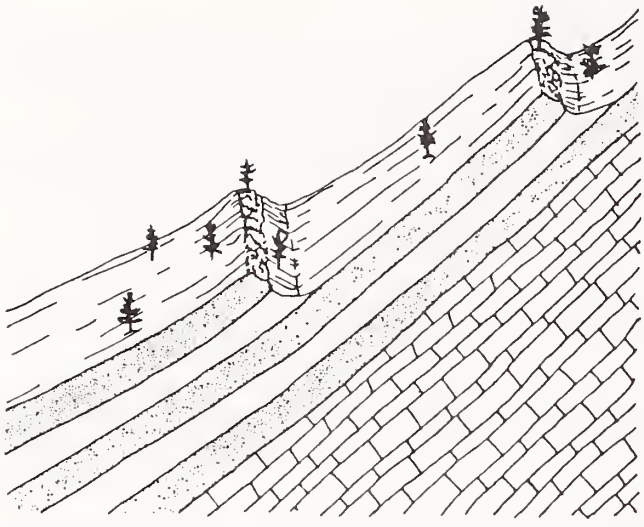
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	40-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 84-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping to moderately steep, structurally controlled slopes (dip/scarp slopes) (block diagram). Delineations are mainly in the northern Gallatin and Absaroka-Beartooth ranges with some in the northern Bridgers and southern Madison Range.

M.U. COMPONENTS This unit contains an association of moderately fine textured soils. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is lower subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have slopes where the dip of the underlying bedrock does not determine the slope of the land surface.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Northern	6,500-7,200	5

The unit consists of long, smooth linear slopes with small benches or concave valleys. The slope of the long, smooth slopes conforms approximately to underlying bedrock dip. The dip of the underlying bedrock is nearly perpendicular to the sides of small benches or valleys. These landforms have the appearance of large flat benches that have been tilted up at one end. Normally, these surfaces are wider at their base and gradually taper upward. Landslide deposits occur locally where moisture is concentrated. These hummocky deposits are associated with drainages and large seeps. Bedrock outcrops occur along the margins of dipslopes. These landforms are dissected by poorly defined, perennial streams. The drainage system has a trellis pattern controlled by bedrock structure with moderate channel gradients. They have high subsurface water storage capacity and surface runoff occurs rarely. These landforms have moderate landslide hazards.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) - 50 percent and Douglas-fir/ninebark (PSME/PHMA) and Douglas-fir/snowberry (PSME/SYAL) - 30 percent.

An included HT with dissimilar management implications is Idaho fescue/bearded wheatgrass (FEID/AGCA) - 15 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL occurs at higher elevations. PSME/PHMA and PSME/SYAL occur on long smooth slopes at lower elevations. Engelmann spruce/ninebark (PICEA/PHMA); Engelmann spruce/twinflower (PICEA/LIBO); and subalpine fir/virginsbower (ABLA/CLPS) are included similar HTs. Cool, moist climates and moderately productive timber sites are associated with these HTs in this unit.

Included are up to 15 percent dissimilar HTs. FEID/AGCA occurs in moist meadows.

EXISTING VEGETATION consists of dense lodgepole pine forests at upper and Douglas fir forests at lower elevations. Mountain meadows are scattered throughout the forest on small benches, in valleys, or along drainageways. The forest understory is dominated by snowberry, and ninebark at low to mid elevations. Blue huckleberry is dominant at higher elevations. The moist meadows contain bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium. Big sagebrush is occassionally present.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, mudstone, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone, shale, mudstone or siltstone. The slope of the land surface conforms approximately to underlying bedrock dip. The bedrock is upper Cretaceous through Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. Landslide hazards are associated with shales and with dipslopes.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quandrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well drained, with moderately fine to fine textures. Subsoils contain 3-35 percent subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation patterns. Soils formed under forest have thin, dark colored surface layers. Included are similar soils with more subsoil rock fragments or lighter colored surface layers. These soils occupy 70 percent of the unit. Soils formed in meadows have dark colored surface layers. Included similar soils have slightly thicker dark colored surface layers. These soils occupy 15 percent of the unit.

Included are small areas of dissimilar soils. Somewhat poorly drained soils with dark surface layers are near seeps, springs, and along streams. They occupy 10 percent of the unit and have lower bearing strength.

GENERAL DESCRIPTION The forested soils have light brownish gray, loam surface layers about 14 inches thick. Subsoils are light yellowish brown gravelly clay loam about 22 inches thick. The substratum, a pale brown gravelly clay loam, overlies bedrock at depths of greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 6 for more detail.

The meadow soils have brown silt loam to loam surface layers about 8 inches thick. Subsoils are light yellowish brown, clay, silty clay loam, or silty clay about 13 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 15 for more detail.

CLASSIFICATION REMARKS The forested soils are Mollic Cryoboralfs, fine loamy, mixed. Included similar soils are Typic Cryoboralfs, fine loamy, mixed and Mollic Cryoboralfs, loamy skeletal, mixed. The meadow soils are Argic Cryoborolls, fine, mixed. Included similar soils are Argic Pachic Cryoborolls, fine loamy, mixed.

The included dissimilar somewhat poorly drained soils are Argiaquic Cryoborolls, fine, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 47-69 cu. ft./acre. Slope steepness limits equipment operation on portions of the unit. Under certain moisture conditions, equipment operation can compact or rut the soil. Operating equipment only when the soil is dry, snow covered or using cable yarding systems helps overcome this limitation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before locating roads. The material exposed by road consrtuction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is moderately suited to range management. The included meadows occupy 15 percent of the unit but produce 90 percent of the avaialble forage. The location of forage in widely scattered areas limits accessibility. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. The forest understory produces little forage. The forest understory is moderately suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose, and grizzly bear habitat. The unit provides potentially good winter moose habitat when subalpine fir seedlings occur in the forest understory. The unit does not normally contain trout habitat but borders streams that do.

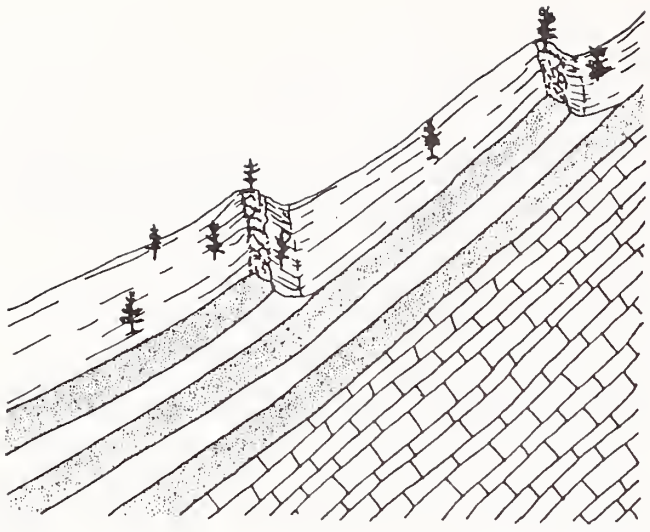
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 84-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping to moderately steep structurally controlled slopes (dip/scarp slopes) (block diagram). Delineations are mainly in the northern Gallatin Range and northern Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains moderately fine textured soils. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is mountain grassland with some open grown to dense Douglas-fir forest.

ADJOINING M.U. Adjacent units have slopes where the dip of the underlying bedrock does not determine the slope of the land surface.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Southern	6,000-7,000	5

The unit consists of long, smooth linear slopes with small benches or concave valleys. The slope of the long smooth slopes conforms approximately to underlying bedrock dip. The underlying bedrock is nearly perpendicular to the sides of small benches or valleys. These landforms have the appearance of large flat benches that have been tilted up at one end. Normally, these surfaces are wider at their base and gradually taper upward. Landslide deposits occur locally where moisture is concentrated. These hummocky deposits are associated with drainages and large seeps. Bedrock outcrops occur along the margins of dipslopes. These forms are dissected by poorly defined, perennial streams. The drainage system has a trellis pattern controlled by bedrock structure, with moderate channel gradients. They have high subsurface water storage capacity and surface runoff occurs rarely. These landforms have moderate landslide hazards.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit is composed of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and big sagebrush/Idaho fescue (ARTR/FEID) - 80 percent. Included HTs with dissimilar management implications are Douglas-fir/ninebark (PSME/PHMA) - 10 percent; and Engelmann spruce HTs with forb understory unions - 5 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic pattern throughout the unit. Warm, dry climates and moderately productive range sites are assoicated with these HTs in this unit.

Included are up to 15 percent dissimilar forest HTs. PSME/PHMA occurs at lower elevations. Engelmann spruce HTs with forb understory unions occur on moist sites along streams. They are timber sites.

EXISTING VEGETATION consists of a mosaic of mountain grasslands and shrublands with open grown to dense Douglas-fir forest. The grasslands contain Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrublands have a canopy of big sagebrush with an understory dominated by Idaho fescue. Bluebunch wheatgrass, junegrass and forbs are common. On more moist sites, sticky geranium, bearded wheatgrass mountain brome and timber oatgrass are included in the understory. The forest has a shrub or forb understory in dense stands. Grasses dominate the understory of open grown stands. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, mudstone, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone, shale, mudstone or siltstone. The slope of the land surface conforms approximately to bedrock dip. The bedrock is upper Cretaceous through Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. Landslide hazards are associated with some of the shale formations.

Included bedrock with dissimilar properties is light colored sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately fine textures. Subsoils contain 3-15 percent subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of soils with dark colored surface layers and subsoil clay accumulations. Included similar soils have thicker dark colored surface layers or subsoils containing more than 35 percent rock fragments. These soils occupy 75 percent of the unit.

Small areas of dissimilar soils are included. Soils without subsoil clay accumulations, which can have light colored surface layers are on ridges underlain by sandstone or in forested areas. They occupy 20 percent of the unit. They are either less productive range or timber sites.

GENERAL DESCRIPTION The soil surface is covered with a partially decomposed litter layer less than 1 inch thick. The surface layer is grayish brown, silt loam about 10 inches thick. The upper subsoil is pale brown clay loam about 8 inches thick. The lower subsoil is light yellowish brown clay loam about 16 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 9 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Argiborolls, fine loamy, mixed. Included as similar are Pachic Argiborolls, fine loamy, mixed and Typic Argiborolls, loamy skeletal, mixed.

The included dissimilar soils without clay subsoil accumulations are Typic Haploborolls, loamy skeletal, mixed and Typic Ustochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated prior to planning or locating roads. The material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is well suited to range management. The potential native plant communities produce 1,634-1,820 pounds per acre of air dry herbage in normal years. Livestock prefer the vegetation on moist sites along streams and tend to concentrate in these areas. In places, sagebrush control improves forage production. Timothy has invaded these grasslands in places. This may affect season of use and utilization. The included forested areas produce little forage. Forage production of the forest understory increases after timber harvest and these areas are well suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good winter mule deer and elk habitat. It is potenially good blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do.

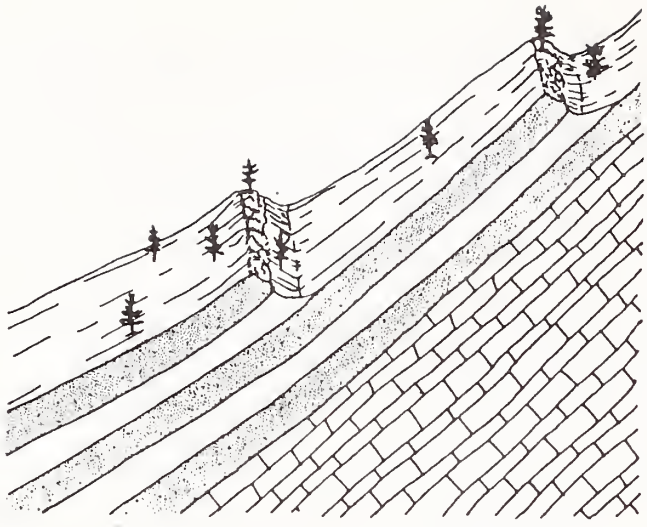
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-25
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 84-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping, structurally controlled slopes (dip/scarp complex) (block diagram). Delineations are mainly in the Bridger range with some in the western Crazy Mountains.

M.U. COMPONENTS This unit contains an association of moderately fine textured soils. They have formed in material weathered from thinly bedded sandstone and shale. Native vegetation is dense lower subalpine forest with scattered mountain grassland.

ADJOINING M.U. Adjacent units have structurally controlled slopes where the dip of the underlying bedrock does not determine the slope of the land surface.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-20	Variable	6,400-7,000	5

The unit consists of long, smooth linear slopes with small benches or concave valleys. The slope of the long, smooth slopes conforms approximately to underlying bedrock dip. The bedrock dip is nearly perpendicular to the sides of small benches or valleys. These landforms have the appearance of large flat benches that have been tilted up at one end. Normally, these surfaces are wider at their base and gradually taper upward. Landslide deposits occur locally where moisture is concentrated. These hummocky deposits are associated with drainages and large seeps. Bedrock outcrops occur along the margins of dipslopes on ridges and steep sideslopes. These landforms are dissected by poorly defined perennial streams. The drainage system has a trellis pattern controlled by bedrock structure with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/pinegrass (ABLA/CARU) - 55 percent; Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 20 percent. Included HTs with dissimilar management implications are Douglas fir/snowberry (PSME/SYAL) - 15 percent and other Douglas-fir and limber pine (PIFL) HTs with bunchgrass understory unions - 5 percent.

HABITAT TYPE DISTRIBUTION At mid to high elevations ABLA/VAGL occurs on northern and ABLA/CARU on southern exposures. Subalpine fir/heartleaf arnica (ABLA/ARCO) is an included similar HT at higher elevations. Cool, moist climates and moderately productive timber sites are associated with these HTs in this unit. FEID/AGSP occurs in mountain grasslands. Idaho fescue/bearded wheatgrass is a similar included HT. Moderately productive range sites are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. PSME/SYAL and Douglas-fir or limber pine HTs with bunchgrass understory unions occur at lower elevations on southern exposures. They are less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest at higher and Douglas-fir forest at lower elevations. Mountain grasslands occur on small benches or along drainages. The forest understory is dominated by shrubs on northern and grasses and forbs on southern exposures. Blue huckleberry is dominant on northern and pinegrass on southern exposures. The grasslands are dominated by Idaho fescue, and bluebunch wheatgrass. Big sagebrush may occur on drier sites and taller grasses on more moist sites. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by sandstone and shales - 90 percent; volcanic rocks and hard crystalline rocks - 10 percent.

The bedrock consists of thick beds of dark colored sandstone interbedded with thin beds of shale and siltstone. These rocks are part of the Livingston group of Tertiary age. Volcanic rocks are included as similar.

Included bedrock with dissimilar properties are hard crystalline rocks. These occur as dikes and sills on ridgetops. The material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. Subsoils contain 35-50 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils formed under dense forest have thin, dark colored surface layers. Included similar soils have fewer subsoil rock fragments. These soils occupy 70 percent of the unit. Soils formed in mountain grasslands have dark colored surface layers. Included similar soils have slightly thicker dark colored surface layers and fewer subsoil rock fragments. These soils occupy 20 percent of the unit.

Small areas of dissimilar soils are included. Soils with light colored surface layers occur near rock outcrops and occupy 5 percent of the unit. These soils are less productive timber sites.

GENERAL DESCRIPTION Soils under dense forest have dark grayish brown, gravelly loam surface layers about 9 inches thick. Subsoils are yellowish brown, very cobbly clay loam about 29 inches thick. The substratum, a very pale brown, very stony loam, overlies bedrock at depths of 4 to more than 5 feet. See soil description 7 for more detail.

Soils in grasslands have brown, loam surface layers about 7 inches thick. Subsoils are pale brown, cobbly clay loam about 12 inches thick. The substratum, a very pale brown, very cobbly loam, overlies bedrock at depths of 4 to more than 5 feet. See soil description 17 for more detail.

CLASSIFICATION REMARKS Soils under dense forest are Mollic Cryoboralfs, loamy skeletal, mixed. Included similar soils are Mollic Cryoboralfs, fine loamy, mixed. Soils in mountain grasslands are Argic Cryoborolls, loamy skeletal, mixed. Included similar soils are Argic Pachic Cryoborolls, fine loamy, mixed.

The included dissimilar soils with light colored surface layers are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 48 to 69 cu. ft./acre. Under certain moisture conditions, equipment operation may compact or rut the soil. This limitation may be overcome by using equipment only when the soil is dry or covered with snow. In some locations, rock fragments on the surface or in the soil make planting difficult. Regeneration in Douglas fir habitat types can be moderately limited by competition. Shelterwood and selection silvicultural harvesting systems improve regeneration. Immediate site preparation and planting after harvest also can help.

ROADS The unit is well suited to road construction. Material exposed by road construction is slippery when wet. Surfacing or seasonal closure helps overcome this limitation.

RANGE The unit is moderately suited to range management. The potential native plant communities produce about 1634 pounds of herbage per acre in normal years. The mountain grasslands occupy 20 percent of the unit but produce 80 percent of the available forage. The location of forage in widely scattered areas limits accessibility. Timothy has invaded some grasslands. This can alter grazing seasons and affect utilization. The forest understory produces little forage. The forested sites are poorly suited for use as transitory range following timber harvest. WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer and elk habitat. It is potentially good summer and fall blue grouse habitat The unit does not normally contain trout habitat but borders streams that do.

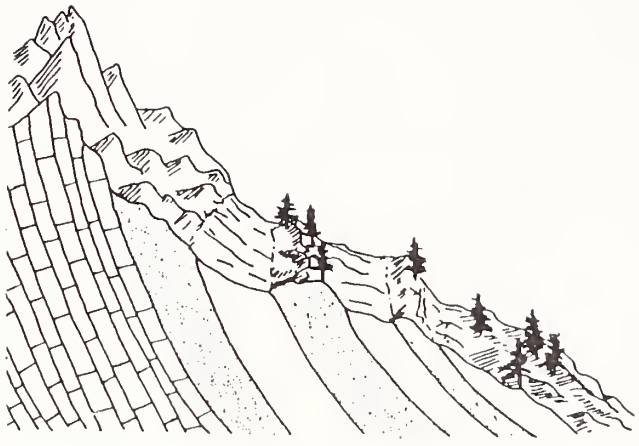
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 85-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep ridges formed by steeply dipping bedrock (left side of the block diagram). Delineations are mainly in the northern Gallatin Range, Bridger Range, and northern Absaroka-Beartooth Range with some northwest of Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium textured. They have formed in material weathered from limestone and sandstone. Native vegetation is open grown to dense Douglas-fir forest and mountain grassland.

ADJOINING M.U. Adjacent units are underlain by interbedded sandstone and shale bedrock or are entirely dense forest or mountain grassland.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	N/S	6,800-8,200	25

The unit consists of ridges with steep rocky slopes. Slopes are strongly controlled by underlying bedrock dip. Bedrock outcrops are common and occur throughout the unit. These outcrops normally form prominent cliffs, which are very striking and picturesque. These ridges are dissected by well defined, intermittent streams. The drainage system has a parallel pattern controlled by bedrock structure with steep channel gradients. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/Idaho fescue (PSME/FEID) - 40 percent; and Douglas-fir/snowberry (PSME/SYAL) and Douglas fir/ninebark (PSME/PHMA) - 25 percent. Included HT with dissimilar management implications are subalpine fir (ABLA) or Engelmann spruce (PIEN) HTs - 10 percent.

HABITAT TYPE DISTRIBUTION PSME/FEID occurs on low elevation southern exposures. An included similar HT is Idaho fescue/bluebunch wheatgrass (FEID/AGSP). PSME/SYAL and PSME/PHMA occur at higher elevations and on low elevation northern exposures. An included similar HT is Douglas fir/virgin's bower (PSME/CLPS). Warm, dry climates and low to moderate timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. Subalpine fir and Engelmann spruce HTs occur on northern exposures and are more productive timber sites.

EXISTING VEGETATION consists of open grown to dense Douglas-fir forest with some dense lodgepole pine forest on higher elevations northern exposures. At higher elevations and on lower elevation northern exposures, the forest understory is dominated by shrubs. Blue huckleberry is at the highest elevations. Ninebark and snowberry are at mid and lower elevations. The open grown forests are on southern exposures or at low elevations. The understory is dominated by bunchgrasses, with Idaho fescue and bluebunch wheatgrass most common. Douglas-fir forests tend to consist of short trees with poor form, especially on low elevation southern exposures.

GEOLOGY

OCCURRENCE The unit is underlain limestone - 80 percent; and interbedded sandstone and shale - 20 percent.

The bedrock consists of thick beds of limestone of Paleozioc age. Typically, they are from the Madison group. The Amsden formation has stained some of the gray limestone red, creating picturesque landscape features. Calcareous sandstones are included as similar.

Included bedrocks with dissimilar properties are quartzitic sandstone and thinly bedded shales. The sandstone weathers to form more erodible coarser textured material. The shales weather to form finer textured material with higher landslide hazards.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with medium textures. Subsoils contain 35-50 percent subangular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 25 percent of the unit and is mostly on southern exposures. Soil properties vary with aspect and vegetation. Soils formed on southern exposures under open grown forests have moderately light colored surface layers and strongly calcareous subsoils. They occupy 40 percent of the unit. Soils formed on northern exposures or under dense forest have very light colored surface layers and slightly calcareous subsoils. They occupy 20 percent of the unit.

Included are up to 15 percent dissimilar soils. Moderately fine textured soils are on northern exposures under dense subalpine fir or Engelmann spruce forests. They are more productive timber sites.

GENERAL DESCRIPTION The soils on southern exposures have grayish brown, very gravelly loam surface layers about 11 inches thick that are calcareous. Subsoils are pale brown, very gravelly loams about 8 inches thick that are strongly calcareous. The substratum, a very pale brown, very cobbly loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 13 for more detail.

The soils on northern exposures have light brownish gray, gravelly loam surface layers about 8 inches thick. Subsoils are grayish brown, very gravelly loam, about 14 inches thick that are slightly calcareous. The substratum, a yellowish brown very gravelly loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 25 for more detail.

CLASSIFICATION REMARKS The soils on southern exposures under open grown forests are Typic Calciborolls, loamy skeletal, carbonatic. The soils on northern exposures under dense forests are Typic Ustochrepts, loamy skeletal, mixed, frigid.

The included dissimilar moderately fine textured soils are Typic Eutroboralfs and Mollic Eutroboralfs in fine loamy and loamy skeletal families.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 16 to 26 cu. ft./acre on southern and 36 to 50 on northern exposures. The southern exposures have widely spaced trees. Steep irregular slopes severely limit equipment operation. Cable harvest systems are limited by irregular slope shapes. Regeneration is moderately limited by moisture stress and understory competition. Natural regeneration can occur only in years when seed production is good and precipitation is above average. Use of shelterwood and group selection harvesting systems improve regeneration success. Immediate site preparation and planting after harvest can also help.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special revegetation practices can be required. Cut and fill slopes contrast sharply with the surrounding landscapes.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access. Livestock tend to concentrate on less sloping areas. The southern exposures produce useable forage and production increases following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good fall and winter mule deer habitat. It is potentially good spring blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat nor does it border streams containing habitat.

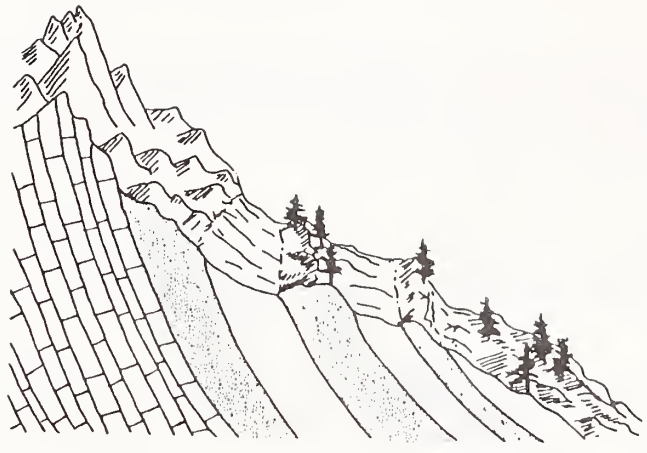
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low-moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low-moderate
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-40
Spring Runoff	March-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 85-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled ridges (left side of block diagram). Delineations are mainly in the the northern Bridger Range, and northern Absaroka-Beartooth Range.

M.U. COMPONENTS The unit contains a complex of soils rock outcrop. Soils are medium to moderately fine textured. They have formed in materials weathered from limestone and sandstone. Native vegetation is dense lower subalpine and Douglas-fir forest with some mountain grassland.

ADJOINING M.U. Adjacent units are underlain by interbedded sandstone and shale bedrock.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,000-7,500	15

The unit consists of ridges with steep concave sideslopes and occasional small benches or saddles. The underlying bedrock strongly controls the shape of these landforms. Ridges are underlain by limestone while the small benches or saddles are underlain by shale, siltstone, or mudstone. Bedrock outcrops are common. These ridges are dissected by well defined perennial streams. The drainage system has a parallel pattern with steep channel gradients. These landforms are stable except where underlain by shale. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/virgins bower (ABLA/CLPS) and subalpine fir/blue huckleberry (ABLA/VAGL) - 45 percent; and Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/ninebark (PSME/PHMA) - 30 percent. An included HT with dissimilar management implications is Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/CLPS and ABLA/VAGL occur at higher elevations. PSME/SYAL and PSME/PHMA occur at lower elevations. Engelmann spruce/ninebark (PIEN/PHMA), is a similar included HT at lower elevations. Warm, moist climates and low to moderate timber productivity are associated with theset HTs in this unit.

Included is up to 10 percent FEID/AGSP in mountain grasslands.

EXISTING VEGETATION consists of dense lodgepole pine forests at higher, and Douglas-fir forests at lower elevations. Mountain grasslands and rock outcrop are scattered throughout the forest. The forest understory is composed of moderately thick stands of shrubs, dominated by virgins bower, blue huckleberry, snowberry and ninebark. Snowberry and ninebark dominate the Douglas fir forest understories.

GEOLOGY

OCCURRENCE The unit is underlain by limestone - 80 percent and interbedded sandstone and shale - 20 percent.

The bedrock consists of thick beds of limestone of Paleozoic age. Typically, they are from the Madison group or older formations. The Amsden formation has stained some of the gray limestone red creating picturesque landscape features. Calcareous sandstones are included as similar bedrocks.

Included bedrocks with dissimilar properties are shale and siltstone. Landslide hazards are associated with these rocks.

SOILS

GENERAL NATURE OF SOILS The soils are well drained and medium to moderately fine textured. Subsoils contain 35-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soil and rock outcrop. Rock outcrop occupies 15 percent of the unit. Soil properties vary with parent material. Soils formed in material partially derived from shale have moderately fine textured subsoils. They occupy 35 percent of the unit. Soils formed in material derived from limestone or sandstone have medium textured subsoils. They occupy 25 percent of the unit.

Included are up to 25 percent dissimilar soils. Soils with subsoils containing less than 35 percent rock fragments have formed in material derived entirely from shale. They are more productive timber sites.

GENERAL DESCRIPTION The soils with moderately fine textured subsoils have pinkish gray, gravelly loam surface layers about 9 inches thick. Subsoils are reddish brown, very cobbly clay loam about 29 inches thick. The substratum, a pinkish gray, calcareous extremely cobbly loam, overlies bedrock at depths of 2 to greater than 5 feet. See soil descriptions 4 and 7 for more detail.

The soils with medium textured subsoils have light brownish gray, gravelly loam surface layers about 7 inches thick. Subsoils are light reddish brown, very cobbly loam about 13 inches thick. The substratum, a light reddish brown extremely cobbly loam, overlies bedrock at depths of 2 to greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils with moderately fine textured subsoils are Cryoboralfs. The most common subgroups are Typic Cryoboralfs and Mollic Cryoboralfs. The soils with medium textured subsoils are Cryochrepts. The most common subgroups are Typic Cryochrepts and Lithic Cryochrepts. All are in loamy skeletal mixed families.

The dissimilar soils with subsoils containing less than 35 percent rock fragments are Cryoborolls and Cryoboralfs in fine loamy mixed or fine, mixed families.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is 34 to 52 cu. ft./acre. Steep irregular slopes severely limit equipment operation. Slope irregularly limits use of cable logging systems. Moisture stress moderately limits regeneration. Natural regeneration may be limited to years when seed production is good and precipitation is above average.

ROADS The unit is moderately suited to road construction. Non-rippable bedrock moderately limits excavation and road placement. Slope steepness increases the quantity of material excavated. The included shale bedrock has a moderate landslide hazard. Slope stability should be evaluated before locating roads across areas underlain by shale. Material exposed by road construction is difficult to revegetate. Special revegetation practices can be required to reestablish vegetation. Cut and fill slopes are highly visible.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage and livestock tend to concentrate in stream bottoms. The forest understory produces little forage. These forest sites are poorly suited for transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer habitat. It is potentially good summer and fall blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	low
Sediment Delivery Efficiency	moderate
Timber Productivity	low to moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 85-3A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep ridges formed by steeply dipping bedrock (block diagram). Delineations are mainly in the eastern Bridger Range (Bangtails), and on the fringes of the Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured with light and dark colored surface layers. They have formed in material weathered from thinly bedded sandstone and shale. Native vegetation is dense to open grown Douglas-fir forest and mountain grasslands.

ADJOINING M.U. Adjacent units have steep slopes with dense forest vegetation or gentle slopes with grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,300-7,200	20

The unit consists of ridges with steep slopes and local relief strongly controlled by underlying bedrock dip. Sandstone beds form ridges and shale beds form concave swales or small valleys on sideslopes. Bedrock outcrops are on ridgetops and steep side slopes. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic to rectangular pattern controlled by bedrock structure with steep channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/Idaho fescue (PSME/FEID) -40 percent; and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) or big sagebrush/bluebunch wheatgrass (ARTR/FEID) - 30 percent. An included HT with dissimilar management implications is subalpine fir/blue huckleberry (ABLA/VAGL) - 10 percent.

HABITAT TYPE DISTRIBUTION PSME/SYAL occurs at higher elevations, and on northern exposures, at lower elevations. PSME/FEID, FIED/AGSP and ARTR/FEID occur at lower elevations and on southern exposures. Limber pine (PIFL) HTs with bunchgrass understory unions and Idaho fescue/bearded wheatgrass (FEID/AGCA) are similar included HTs. Warm, dry climates and low timber productivity are associated with the forest HTs in this unit. Moderately productive range sties are associated with the grassland and shrubland HTs.

Included are up to 10 percent dissimilar HTs. ABLA/VAGL occurs on northern exposures at higher elevations and is a more productive timber site.

EXISTING VEGETATION consists of dense Douglas-fir forest on northern exposures and open grown Douglas-fir forest mixed with mountain grasslands or shrub-lands on southern exposures. On northern exposures, the forest understory is dominated by shrubs, with snowberry most common. On southern exposures, the forest understory is dominated by bunchgrasses with bluebunch wheatgrass and Idaho fescue most common. The mountain grasslands contain Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The mountain shrublands contain a canopy of big sagebrush with an understory dominated by Idaho fescue and common forbs. On more moist sites, sticky geranium and a greater variety of forbs and grasses occur. Douglas-fir seedlings frequently invade grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by sandstone and shale - 90 percent; volcanic rocks and hard crystalline rocks - 10 percent.

The bedrock consists of thick beds of dark colored sandstone interbedded with thin shale and siltstone beds. These rocks are part of the Livingston group and are Tertiary in age. Volcanic rocks are included similar bedrocks.

Included bedrocks with dissimilar properties are hard crystalline rocks. These are scattered throughout the unit as dikes and sills, often on ridgetops. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with light or dark colored surface layers and medium to moderately fine textures. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop occupies 20 percent of unit and typically is on ridgetops and steeper sideslopes. Soil properties vary with vegetation and aspect. Soils having somewhat dark colored surface layers occur under dense Douglas-fir forest on northern exposures. Included are similar soils with lighter colored surface layers. These soils occupy 35 percent of the unit. Soils with dark colored surface layers occur under grassland or open canopy Douglas-fir forest on southern exposures. These soils occupy 35 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with light colored surface layers and moderately coarse textured subsoils occur near ridgetops or sandstone outcrops. Some of these soils are shallow. They are on less productive timber sites, and are more erodible.

GENERAL DESCRIPTION The soils with somewhat dark colored surface layers have pale brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown, very gravelly clay loam about 29 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

The soils with dark colored surface layers have brown loam surface layers about 7 inches thick. Subsoils are pale brown, very gravelly clay loam about 12 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils with somewhat dark colored surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. The similar included soils are Typic Cryoboralfs, loamy skeletal, mixed. The soils dark with colored surface layers are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed and Lithic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 26-64 cu. ft./acre. Slope steepness severely limits equipment operation. Cable or aerial yarding systems can overcome this limitation. Regeneration is severely limited by grass and shrub competition. Use of shelterwood and group selection silvicultural systems improve regeneration success. Immediate site preparation and planting after harvest can also help. Natural regeneration can be limited to years when seed production is good and precipitation is above average.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Bedrock is easily excavated. The material exposed by road construction is slippery when wet. Surfacing or seasonal closures help overcome this limitation. Revegetation of road cut and full slopes helps control erosion.

RANGE The unit is poorly suited to range management. The potential native plant communities produce 1245 to 1408 pounds per acre of air dry herbage in normal years. Slope steepness severely limits access. Livestock tend to concentrate on less sloping areas. The forest understory produces little useable forage, but production increases following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good summer, fall, and winter mule deer habitat. It also provides good summer and fall blue grouse habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat but borders streams that do. If erosion occurs, it is a potential source of sediment which can damage fish habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrublsnd Productivity	low to moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-60
Spring Runoff	April-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 85-3B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep ridges formed by steeply dipping bedrock (block diagram). Delineations are mainly in the eastern Bridger Range (Bangtails), and on the fringes of the Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of soils. Soils are medium to moderately fine textured with somewhat dark and dark colored surface layers. They have formed in material weathered from thinly bedded sandstone and shale. Native vegetation is dense subalpine and Douglas-fir forest with some mountain grassland.

ADJOINING M.U. Adjacent units have steep slopes with dense to open grown forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	6,600-7,800	10

The unit consists of ridges with steep slopes and local relief strongly controlled by underlying bedrock dip. Sandstone beds form ridges and shale, siltstone, or mudstone form concave swales or small valleys on sideslopes. Bedrock outcrops are on ridgetops and steep side slopes. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic to rectangular pattern controlled by bedrock structure with steep channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-blue huckleberry (ABLA/VAGL), and subalpine fir/pinegrass (ABLA/CARU) - 60 percent; and Douglas-fir/snowberry (PSME/SYAL) - 20 percent. Included HTs with dissimilar management implications are Idaho fescue/bluebunch wheatgrass (FIED/AGSP) or big sagebrush/Idaho fescue (ARTR/FEID) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL occurs at mid elevations or on northern exposures at all elevations. On southern exposures, ABLA/CARU occurs at higher and PSME/SYAL occurs at lower elevations. Subalpine fir/grouse whortleberry is an included similar HT on northern exposures. Cool to warm, moist climates and moderately productive timber sites are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ARTR/FEID is in mountain shrubland parks and FEID/AGSP is in mountain grassland parks. They are range sites.

EXISTING VEGETATION consists of dense lodgepole pine or Douglas-fir forests with scattered mountain grassland or shrubland parks. The forest understory consists of dense mats of shrubs, dominated by blue huckleberry on northern exposures. On southern exposures, the understory is dominantly grasses and forbs with pinegrass dominant. Mountain grassland parks contain abundant Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. Shrubland parks contain big sagebrush canopies with an understory dominated by Idaho fescue and common forbs. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by sandstone and shale - 90 percent; volcanic rocks and hard crystalline rocks - 10 percent.

The principal bedrock consists of thick beds of dark colored sandstone interbedded with thin shale and siltstone beds. These rocks are part of the Livingston group and are Tertiary in age. Volcanic rocks are included as similar bedrock.

Included bedrocks with dissimilar properties are hard crystalline rocks. These are scattered throughout the unit as dikes and sills, often on ridgetops. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with somewhat dark or dark colored surface layers and medium to moderately fine textures. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils with somewhat dark colored surface layers occur under dense forest. Included similar soils have lighter colored surface layers. These soils occupy 60 percent of the unit. Soils with dark colored surface layers occur in mountain grassland, shrubland, or under open canopied Douglas-fir forest. They occupy 20 percent of the unit.

Included are up to 10 percent dissimilar soils. Soils with light colored surface layers and moderately coarse textured subsoils occur near ridgetops or sandstone outcrops. Some of these soils are shallow. They are on less productive timber sites and are more erodible.

GENERAL DESCRIPTION The soils with somewhat dark colored surface layers have pale brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown, very gravelly clay loam about 29 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 7 for more detail.

The soils with dark colored surface layers have brown loam surface layers about 7 inches thick. Subsoils are very gravelly clay loam about 12 inches thick. The substratum, a pale brown, very cobbly loam or clay loam, overlies bedrock at depths greater than 5 feet. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils with somewhat dark colored surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. The similar included soils are Typic Cryoboralfs, loamy skeletal, mixed. The soils with dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed and Lithic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber production. The potential annual production of subalpine forest is 53 to 69 cu. ft./acre, and of Douglas fir forest is 36 to 64 cu. ft./acre. Slope steepness severely limits equipment operation. Cable or aerial yarding systems overcome this limitation. Regeneration is moderately limited by understory competition on southern exposures. In these areas, use of shelterwood and group silvicultural systems improve regeneration success. Immediate site preparation and planting after harvest can also help.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. The material exposed by road construction is erodible. revegetation of and fill slopes helps control erosion. Unsurfaced roads can become rutted when wet and dusty when dry. Surfacing or seasonal road closures help overcome these limitations.

RANGE The unit is poorly suited to range management. Slope steepness severely limits access to forage. Livestock tend to concentrate on small less sloping areas. The included grassland parks occupy 10 percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. The forest understory produces little forage. Forage production increases following timber harvest.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer habitat. It also provides good summer and fall blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do. If erosion occurs, it is a potential source of sediment which can damage fish habitat.

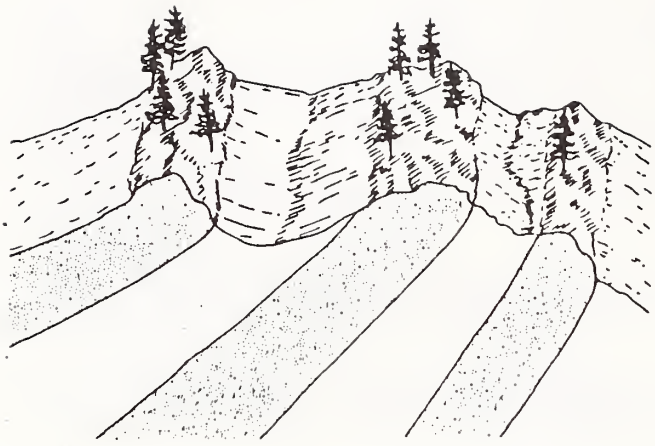
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping to moderately steep, structurally controlled slopes (block diagram). Delineations are mainly in the Gallatin Range, southern Madison Range, Hebgen Lake area, and Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains an association of soils. Soils are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is dense lower subalpine forest and mountain meadows.

ADJOINING M.U. Adjacent units have steep structurally controlled slopes, mountain grassland or dense upper subalpine fore

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	6,800-8,000	5

The unit consists of ridges with gently sloping to moderately steep concave slopes and occassional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops. Small valleys and swales are underlain by "soft" shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock. Slope of the land surface seldom conforms to underlying bedrock dip. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a dendritic or rectangular pattern with low channel gradients. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/twin flower (ABLA/LIBO) - 45 percent; and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 30 percent. Included HTs with dissimilar management implications are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 10 percent; and Douglas-fir HTs with shrubby understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/LIBO are in forested areas. Similar included HTs are subalpine fir/heartleaf arnica (ABLA/ARCO), subalpine fir/grouse whortleberry (ABLA/VASC) and Engelmann spruce (PIEN) HTs. Cool, moist climates and moderate timber productivity are associated with these HTs. FEID/AGCA is in mountain meadows. Similar included HTs are big sagebrush/Idaho fescue (ARTR/FEID) and Idaho fescue/ bluebunch wheatgrass (FEID/AGSP). Cool moist climates and high range productivity are associated with these HTs in this unit.

Included are up to 20 percent dissimilar HTs. ABLA-PIAL/VASC, is at upper elevations on less productive timber sites. Doulgas-fir HTs are at lower elevations on sites where forest regeneration is more difficult.

EXISTING VEGETATION consists of dense lodgepole pine and subalpine fir forest with large mountain meadows. The forest understory is composed of a thick mat of shrubs dominated by blue huckleberry, twin flower, and grouse whortleberry. Heartleaf arnica, virgins bower and pinegrass also occur. The mountain meadows consist primarily of bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium and abundant forbs. Occasionally, big sagebrush forms a dense overstory.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. Slope of the land surface seldom conforms underlying bedrock dip. The bedrock is upper Cretaceous to Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quandrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well drained and moderately fine textured with subsoil clay accumulation. Subsoils contain 10-20 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation. Soils formed under forest have light colored surface layers. Included are similar soils with more subsoil rock fragments or darker colored surface layers. These soils occupy 40 percent of the unit. Soils formed in mountain or meadows have dark colored surface layers. Similar included soils have more subsoil rock fragments. These soils occupy 40 percent of the unit.

Included are up to 15 percent dissimilar coarser textured soils with greater than 35 percent subsoil rock fragments. These soils are near sandstone outcrops on less productive timber sites.

GENERAL DESCRIPTION The forested soils have very pale brown, loam surface layers about 9 inches thick. Subsoils are yellowish brown, clay loam or gravelly clay loam about 23 inches thick. The substratum, a variably colored, gravelly clay loam, overlies bedrock at depths of 3 to greater than 5 feet. Soil colors are more variable because of variable parent material colors. See soil description 3 for more detail.

The meadow soils have dark grayish brown, silt loam surface layers about 8 inches thick. Subsoils have variably colored clay loams about 13 inches thick. The substratum, a variably colored gravelly or cobbly clay loam overlies bedrock at depths of 3 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 16 for more detail.

CLASSIFICATION REMARKS The forested soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. Similar soils are Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, fine loamy mixed. The meadow soils are Argic Cryoborolls, fine loamy mixed. Similar soils are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production in forested areas is 53 to 69 cu. ft./acre. The unit is generally well suited to tractor operation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides. Under certain moisture conditions, equipment operation can compact or rut the soil. This limitation can be overcome by using equipment when soil is dry, covered with snow, or by using cable yarding systems. Understory vegetation competes slightly with tree seedlings in some areas. Reducing competing vegetation overcomes this limitation.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before planning or locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native meadow plant community produces about 2,225 pounds per acre of air dry herbage in normal years. The meadow areas occupy 30 percent of the unit but provide over 90 percent of the available forage. Timothy may have invaded these meadows. This may affect season of use and utilization. The forest industry provides little forage. Forage production increases after timber harvest and these areas are moderately suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall elk and moose habitat. Good summer grizzly bear habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

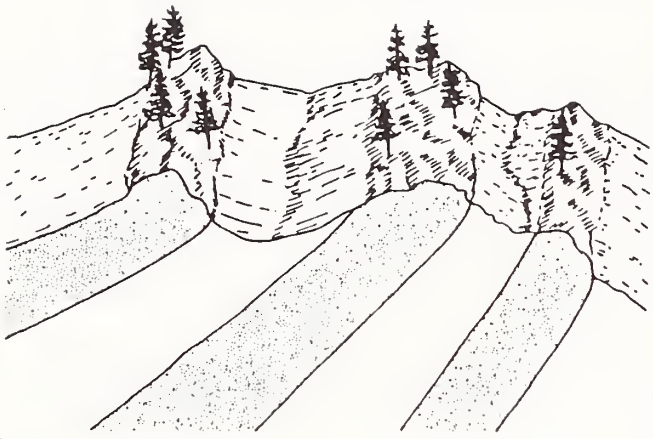
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep structurally controlled slopes (block diagram). Delineations are mainly in the northern Bridger Range, the northern Absaroka-Beartooth Range, the northern Gallatin Range, with most in the southern Madison Range.

M.U. COMPONENTS Soils are moderately fine textured with dark colored surface layers. They have formed in materials weathered from thickly bedded sandstone and shale. Native vegetation is mountain grassland with some subalpine forest.

ADJOINING M.U. Adjacent units have steep, structurally controlled slopes with subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	7,000-8,000	5

The unit consists of ridges with gently sloping to moderately steep concave slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops or steep sideslopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but slope of the land surface seldom conforms to underlying bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic pattern with moderate channel gradients. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and big sagebrush/Idaho fescue (ARTR/FEID) - 85 percent. An included HT with dissimilar management implications is subalpine fir/grouse whortleberry (ABLA/VASC) - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. The similar HT, Idaho fescue/bearded wheatgrass (FEID/AGCA) is in depressions. Warm, dry climates and moderately productive range sites are associated with these HTs.

Included are small areas of the dissimilar HT ABLA/VASC. This HT is found in scattered forest stands with low timber productivity. It occupies up to 10 percent of the unit.

EXISTING VEGETATION consists of mountain grassland and shrubland with a few scattered stands of dense lodgepole pine forest. The mountain grassland contains abundant Idaho fescue, bluebunch, wheatgrass, junegrass, western needlegrass and common forbs. The mountain shrubland contains big sagebrush with Idaho fescue dominating the understory. Bluebunch wheatgrass, junegrass and and forbs are common. On moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are common. Forest understories are dominated by shrubs. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. The bedrock is upper Cretaceous to Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible. Some thin beds of limestone are also present. Weathering products from these bedrocks are high in carbonates.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. They have dark colored surface layers and subsoil clay accumulations. Subsoils contain 10-20 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consist primarily of soils with dark colored surface layers. Included are similar soils with either thicker dark colored surface layers or finer textured subsoils. The included soils are in depressions. These soils occuby 80 percent of the unit.

Included are up to 15 percent dissimilar soils. Soils with more than 35 percent subsoil rock fragments are near sandstone or limestone bedrock exposures. These areas are more stable. Soils containing expandable clays are found in the Taylor Fork drainage of the Madison Range. These clays expand when wet and contract to form cracks when dry. These areas are less stable. Soils with light colored surface layers are in forested areas.

GENERAL DESCRIPTION The major soils have a gray brown silt loam surface layer about 10 inches thick. The subsoil is light yellowish brown clay loam about 14 inches thick. The substratum, a light yellowish brown, gravelly clay loam, overlies bedrock at depths greater than 5 feet. Colors may vary because of parent material colors. See soil description 16 for more detail.

CLASSIFICATION REMARKS The major soils are Argic Cryoborolls, fine loamy, mixed. The included similar soils are Argic Pachic Cryoborolls, fine loamy, mixed; and Argic Cryoborolls, fine, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed, Argic Cryoborolls, fine, montmorillonitic and Typic Cryoboralfs, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Forest stands are scattered and productivity is low.

ROADS The unit is well suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before locating roads. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces 1,634 - 1,820 pounds per acre of dry herbage in normal years. Soils are susceptible to livestock trampling when wet. Sagebrush control improves forage production in places. Timothy has invaded some grasslands. This may affect season of use and utilization.

WILDLIFE-FISHERIES The unit is potentially good fall and winter mule deer and elk habitat. Good spring grizzly bear habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

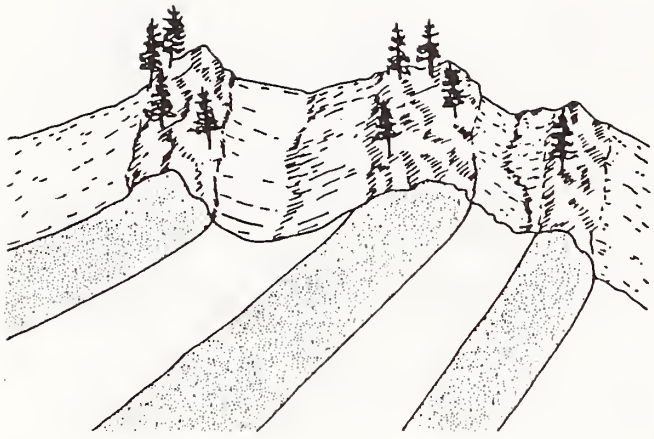
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-40
Spring Runoff	March-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-2D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep, structurally controlled slopes (block diagram). Delineations are mainly in the Gallatin Range, southern Madison Range, with some in the Bridger Range and northern Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of soils. Soils are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is dense lower subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units have steep structurally controlled slopes, slopes where bedrock dip controls landform appearance, or Douglas-fir forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	6,800-7,800	5

The unit consists of ridges with rolling to moderately steep concave slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded rocks. Ridges are generally underlain by sandstone which is often exposed on ridgetops. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to underlying bedrock dip. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a dendritic to rectangular pattern with low channel gradients. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/grouse whortleberry (ABLA/VASC) - 60 percent; and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 15 percent. Included HTs with dissimilar management implications are Idaho fescue/bearded wheatgrass (FEID/AGCA) - 10 percent; and Douglas-fir/blue huckleberry (PSME/VAGL) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL and ABLA/VASC occur throughout the unit. ABLA-PIAL/VASC is at upper elevations. Included similar HTs are subalpine fir/twinflower (ABLA/LIBO) and subalpine fir/heartleaf arnica (ABLA/ARCO) with some subalpine fir/pinegrass (ABLA/CARU) and subalpine fir/beargrass (ABLA/XETE). Cool climates and moderate timber productivity are associated with these HTs. Low timber productivity is associated with ABLA-PIAL/VASC.

Inlcuded are up to 20 percent dissimilar HTs. FEID/AGCA is in scattered meadows. PSME/VAGL is at lower elevations and has moderate regeneration limitations because of moisture stress.

EXISTING VEGETATION consists of dense lodgepole pine and subalpine fir forests with scattered mountain meadows. Douglas-fir forests are at lower elevations. Whitebark pine is an overstory codominant at upper elevations. The forest understory is composed of a thick mat of shrubs dominated by blue huckleberry, twinflower, and grouse whortleberry. Beargrass and pinegrass may also occur. Mountain meadows consist of Idaho fescue, bluebunch wheatgrass, bearded wheatgrass, mountain brome, timber oatgrass and sticky geranium.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. The slope of the land seldom conforms bedrock dip. The bedrock is upper Cretaceous to Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are moderately well drained, with moderately fine textures and subsoil clay accumulations. Subsoils contain 3-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of a complex of soils. Soils are not obviously associated with landscape features. The major soils are under subalpine forests. Soils with light colored surface layers occupy 60 percent of the unit. Included are similar soils with subsoil clay accumulations. Soils with thin dark colored surface layers and greater than 35 percent subsoil rock fragments occupy 30 percent of the unit. Included are similar soils with fewer subsoil rock fragments.

Included are up to 5 percent dissimilar soils. Somewhat poorly drained forested soils are near seeps or stream drainage ways on more productive timber sites. Somewhat poorly drained nonforested soils have dark colored surface layers and are in meadows.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown loam surface layers about 9 inches thick. Subsoils are yellowish brown clay loam about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 3 for more detail.

The soils with thin dark colored surface layers have dark grayish brown, gravelly loam surface layers about 9 inches thick. The subsoils are yellowish brown, very cobbly clay loams about 29 inches thick. The substratum, a very pale brown, very stony clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 7 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. Similar soils are Typic Cryoboralfs, fine, mixed. The soils with thin dark colored surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. Similar soils are Mollic Cryoboralfs, fine loamy, mixed.

The included dissimilar somewhat poorly drained soils are Aquic Cryoboralfs, fine, mixed and Argiaquic Cryoborolls or Aquic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 53 to 71 cu. ft./acre. Ninety percent of the unit is forested but only 75 percent has moderate productivity. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides. The unit is generally well suited to tractor operation. Under certain moisture conditions, equipment operation can compact or rut the soil. This limitation can be overcome by using equipment when soil is dry, covered with snow, or by using cable yarding systems.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before planning or locating roads. Roads need suitable subgrade material because of the low strength and seasonal wetness. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. The included mountain meadows occupy 10 percent of the unit but produce over 90 percent of the available forage. Location of forage in widely scattered areas limits access. The forest understory provides little forage. Forage production increases after timber harvest, and the unit is moderately suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall elk and moose habitat. Good summer grizzly bear habitat is also available. The unit does not normally contain trout habitat but borders streams that do.

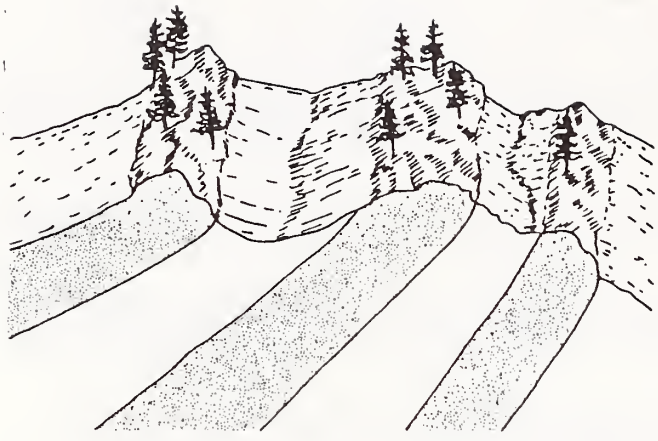
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B-C



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-2E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, structurally controlled slopes (block diagram). Delineations are mainly in the Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS The unit contains an association of soils wtih dark and somewhat dark colored surface layers. Soils are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is open grown to dense upper subalpine forest with some mountain meadows.

ADJOINING M.U. Adjacent units are steep, densely forested slopes or gentle rolling slopes with mountain grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-30	Variable	7,000-8,000	5

The unit consists of gently rolling slopes with small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops and steep slopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to underlying bedrock dip. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a dendritic pattern with moderate channel gradients. They have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bearded wheatgrass (FEID/AGCA) - 45 percent, and subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 35 percent. Included HTs with dissimilar management implications are subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/heartleaf arnica (ABLA/ARCO) - and tufted hairgrass/sedge (DECA/CAREX) - 15 percent.

HABITAT TYPE DISTRIBUTION FEID/AGCA and ABLA-PIAL/VASC form a mosaic throughout the unit. An included similar forested HT is whitebark pine-subalpine fir (PIAL-ABLA) at the highest elevations. FEID/AGCA is in slightly moister locations. Cold moist climates and very low timber productivity are associated with these HTs.

Included are up to 15 percent dissimilar HTs. ABLA/VASC and ABLA/ARCO are at lower elevations on more productive timber sites. DECA/CAREX is in wet meadows.

EXISTING VEGETATION consists of a mosaic of moderately dense forest and mountain meadows. The forests contain whitebark pine, subalpine fir and Engelmann spruce with some lodgepole pine. Most trees are stunted and deformed. The forest understory is composed of a moderately dense mat of shrubs dominated by grouse whortleberry. Heartleaf arnica and other forbs are included. The meadow component of the unit contains bearded wheatgrass, mountain brome, timber oatgrass and common forbs. Sticky geranium occurs in moister areas. The scattered wet meadows contain tufted hairgrass and sedges.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. The land surface seldom conforms to underlying bedrock dip. The bedrock is upper Cretaceous through Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartizitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained with moderately fine textures and subsoil clay accumulations. Subsoils contain 10-30 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation and bedrock properties. Soils with dark surface layers are in meadows. Included are similar soils with very thick, dark surface layers. These soils occupy 45 percent of the unit. Soils with slightly darkened surface layers and few subsoil rock fragments are under moderately open forest canopies. Included are similar soils with light colored surface layers under dense forest canopies. Similar soils with greater than 35 percent subsoil rock fragments or soils with fine textures are underlain by sandstone and shale respectively. These soils occupy 35 percent of the unit.

Included are up to 15 percent dissimilar soils. Coarser textured soils occur near sandstone outcrops. These soils are more erodible. Somewhat poorly drained soils are in wet meadows and have lower bearing strength.

GENERAL DESCRIPTION The soils with dark colored surface layers have grayish brown silt loam surface layers about 8 inches thick. Subsoils are light yellowish brown about 15 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 16 for more detail.

The soils with slightly darkened surface layers have light brownish gray loam surface layers about 14 inches thick. Subsoils are light yellowish brown clay loam or silty clay about 22 inches thick. The substratum, a pale brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. See soil description 6 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. The similar included soils are Argic Pachic Cryborolls, fine loamy, mixed. The soils with slightly darkened surface layers are Mollic Cryoboralfs, fine loamy, mixed. The included soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. The other included soils are Mollic Cryoboralfs, loamy skeletal, mixed; and Mollic Cryoboralfs, fine, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed and Cryaquolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Trees are widely spaced and potential annual production is less than 20 cu. ft./acre. Forest regeneration is severely limited by the harsh subalpine climate.

ROADS The unit is moderately suited to road construction. Snow cover limits use of roads during much of the year. Unstable slopes occur commonly. Slope stability should be evaluated before planning and locating roads. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Revegetation of exposed soils is difficult because of the harsh subalpine climate. Special practices can be required to reestablish vegetation. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is moderately suited to range management. The potential native plant community produces about 2,225 pounds per acre of air dry herbage in normal years. Mountain meadows occupy 45 percent of the unit but provide over 90 percent of the available forage. Snowfall early and late in summer commonly limits livestock use. Grazing should be delayed until the soil is dry to prevent trampling damage to soil and vegetation. Loose harding of sheep is particularly important for proper forage utilization in these alpine meadows. Timothy has invaded some meadows. This can alter grazing seasons and affect utilization. The forest understory produces little forage. The unit is poorly suited for use as transitory range.

WILDLIFE-FISHERIES This unit is potentially good summer and fall elk, moose and grizzly bear habitat. Good fall and winter blue grouse habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	high
Timber Productivity	low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	50-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-3B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling, structurally controlled slopes (block diagram). Delineations are mainly in the central and southern Bridger Range, on the fringes of the Crazy Mountains with a few in the northern Absaroka-Beartooth Range and the southeast Madison Range.

M.U. COMPONENTS The unit contains a complex of soils with light colored and somewhat darkened surface layers. Soils are moderately fine textured. They have formed in material weathered from sandstone and shale. Native vegetation is dense lower subalpine forest and Douglas-fir forest with some mountain grassland.

ADJOINING M.U. Adjacent units have steeper slopes with dense subalpine or Douglas-fir forest or mountain grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-30	Variable	5,500-7,000	5

The unit consists of gently rolling slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridge tops or steep sideslopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic pattern controlled by bedrock structure with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), subalpine fir/blue huckleberry (ABLA/VAGL), and subalpine fir/twinflower (ABLA/LIBO) - 60 percent; Douglas-fir/snowberry (PSME/SYAL) - 25 percent. An included HT with dissimilar management implications is Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC, ABLA/VAGL, and ABLA/LIBO occur throughout the unit. Cool moist climates and moderate timber productivity are associated with these HTs. PSME/SYAL is at lower elevations on southern exposures. Warm moist climates and moderate timber productivity are associated with this HT.

Included are scattered areas of the dissimilar HT, FEID/AGSP, at lower elevations on southern exposures. This HT is a range site, and occupies 10 percent of the unit.

EXISTING VEGETATION consists of dense lodgepole pine forest with some mountain grassland. Douglas fir forests are at lower elevations on southern exposures. The forest understory is composed of a dense mat of shrubs dominated by grouse whortleberry, blue huckleberry and twinflower. Snowberry, pinegrass, and elk sedge are on southern exposures at lower elevations. The mountain grasslands contain Idaho fescue, bluebunch wheatgrass and comon forbs. Douglas-fir seedlings are often found invading these grasslands.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded sandstone and shale - 90 percent; volcanic and hard crystalline rocks - 10 percent.

The bedrock consists of thick beds of dark colored sandstone with thin beds of shale and siltstone. These rocks are part of the Livingston group and are Tertiary in age. Included are some volcanic rocks which are similar.

Included bedrock with dissimilar properties are hard crystalline rocks. These are scattered throughout the unit as dikes and sills, often on ridgetops. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures. Subsoils contain 5 to 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils with light colored surface layers are under dense forest. These soils occupy 55 percent of the unit. Soils with somewhat darkened surface layers are under dense forest bordering grasslands. These soils occupy 30 percent of the unit. Included in both areas are similar soils with either finer textures or more subsoil rock fragments. The latter are near ridgetops or rock outcrops.

Included are up to 10 percent dissimilar soils. Soils with dark colored surface layers are in mountain grasslands.

GENERAL DESCRIPTION The soils with light colored surface layers have very pale brown, loam surface layers about 9 inches thick. Subsoils are yellowish brown gravelly clay loam about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of more than 5 feet. See soil description 3 for more detail.

The soils with slightly darkened surface layers have light brownish gray, loam surface layers about 14 inches thick. Subsoils are light yellowish brown about 22 inches thick. The substratum, a pale brown gravelly clay loam, overlies bedrock at detphs of more than 5 feet. See soil description 6 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. Soils with slightly darkened surface layers are Mollic Cryoboralfs, fine loamy, mixed. Finer textured similar soils are Typic Cryoboralfs, fine, mixed and Mollic Cryoboralfs, fine, mixed. The soils with more subsoil rock fragments are Typic Cryoboralfs, loamy skeletal, mixed; and Mollic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils are Argic Cryoborolls, fine loamy, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to commercial forest production. Potential annual production is 48 to 69 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is slightly limited by moisture stress and competition in Douglas fir forests. Shelterwood or group selection silvicultural systems improve regeneration success. Site preparation, and planting immediately after harvest can also help.

ROADS The unit is well suited to road construction. Unsurfaced roads are slippery and become rutted when wet. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is poorly suited to range management. The included grassland parks occupy 10 percent of the unit but produce over 90 percent of the forage. The location of forage in widely scattered areas limits accessibility. Forest understories produce little forage. The unit is poorly suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer habitat. It also provides good fall blue grouse habitat. The unit does not normally contain trout habitat but borders streams that do.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	moderate
Forest Regeneration Limitations	slight
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B, C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 86-3C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of rolling to moderately steep, structurally controlled slopes (block diagram). Delineations are mainly in the eastern Bridger Range, in the fringes of the Crazy Mountains, and in the Deer Creeks.

M.U. COMPONENTS This unit contains an association of soils. Soils are moderately coarse to moderately fine textured with dark colored surface layers. They have formed in materials weathered from sandstone and shale. Native vegetation is mountain grassland with some Douglas-fir forest.

ADJOINING M.U. Adjacent units are steep, structurally controlled slopes with subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	5,500-7,000	5

The unit consists of gently rolling to moderately steep slopes with occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded rock. Ridges are generally underlain by sandstone which is often exposed on ridgetops and steep slopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These landforms are dissected by well defined, intermittent streams. The drainage system has a dendritic pattern controlled by bedrock structure with moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and big sagebrush/Idaho fescue (ARTR/FEID) - 85 percent. An included HT with dissimilar management implications is Douglas-fir/snowberry (PSME/SYAL) - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID, occur in a mosaic throughout the unit. Douglas-fir/Idaho fescue (PSME/FEID) is a similar included HT. Warm moist climates and moderately productive range sites are associated with these HTs.

The included dissimilar HT, PSME/SYAL, is in isolated forest stands, usually near delineation boundaries. This HT occupies up to 10 percent of the unit.

EXISTING VEGETATION consists of a mosaic of mountain grassland and shrubland with some dense Douglas-fir forest. The grassland contains abundant Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrubland contains big sagebrush with Idaho fescue and common forbs dominating the understory. Bluebunch wheatgrass and junegrass can also be common. On moist sites, sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are common. Understories in the included dissimilar forests are dominated by shrubs. Douglas-fir seedlings frequently invade mountain grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded sandstone and shale with small amounts of volcanic rocks - 90 percent; and hard crystalline rocks - 10 percent.

The bedrock consists of thick beds of dark colored sandstone with thin beds of shale and siltstone. These rocks are part of the Livingston group and are Tertiary in age. Volcanic rock is included as similar bedrock.

Included bedrocks with dissimilar properties are hard crystalline rocks. These occur scattered throughout the unit as dikes and sills. They are often exposed on ridgetops. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained and moderately coarse to moderately fine textured with dark colored surface layers. Subsoils contain 10-35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with topographic position. Soils with dark colored surface layers and subsoil clay accumulations are on gently rolling slopes. Included similar soils have very thick dark surface layers or more subsoil rock fragments. The similar soils with thick surface layers are in depressions while the soils with more subsoil rock fragments are near ridges. These soils occupy 65 percent of the unit. Soils with little subsoil clay accumulation are on ridges where sandstone is near the surface. These soils are moderately coarse textured and contain more subsoil rock fragments. They occupy 25 percent of the unit.

Included are up to 5 percent dissimilar soils. Moderately coarse textured soils with light colored surface layers or shallow soils are near sandstone outcrops. These soils are less productive range sites.

GENERAL DESCRIPTION Soils with dark colored surface layers and subsoil clay accumulations have grayish brown, silt loam surface layers about 8 inches thick. The subsoil is pale brown, silty clay loam or clay loam about 15 inches thick. The substratum, a pale brown, gravelly silty clay loam or loam, overlies bedrock at depths of more than 5 feet. See soil description 1b for more detail.

The dark soils with little subsoil clay accumulation have grayish brown loam or sandy loam surface layers about 14 inches thick. Subsoils are pale brown, very gravelly sandy loam or loam about 17 inches thick. The substratum, a very pale brown, very gravelly sandy loam or loam overlies bedrock at depths of more than 5 feet. See soil description 14 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers and subsoil clay accumulation are Argic Cryoborolls, fine loamy, mixed. The similar included soils are Argic Pachic Cryoborolls, fine loamy, mixed; Argic Cryoborolls, loamy skeletal, mixed, and Typic Argiborolls, fine loamy mixed. The soils with little subsoil clay accumulation are Typic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed; and Lithic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit contains only scattered trees and is poorly suited to timber management.

ROADS The unit is well suited to road construction. Unsurfaced roads are slippery and become rutted when wet. Surfacing or seasonal closures help overcome these limitations.

RANGE The unit is well suited to range management. The potential native plant community produces about 1,820 pounds per acre of dry herbage in normal years. Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand livestock trampling. In places, sagebrush control improves production of desirable forage plants. Timothy has invaded some mountain grasslands. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer habitat. Fair spring and summer blue grouse habitat is also available. The unit does not normally contain trout habitat but borders streams that do.

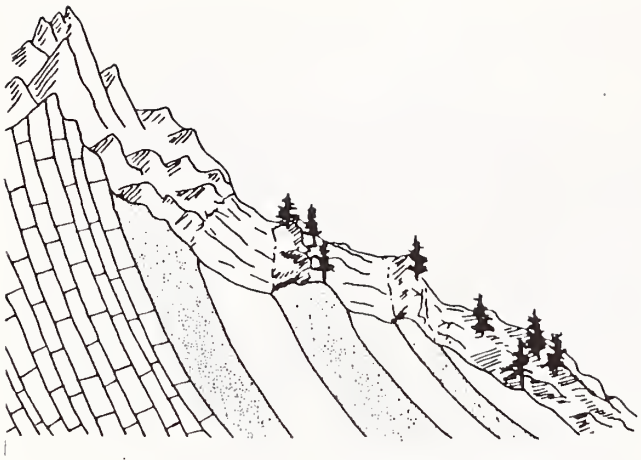
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	10-25
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep rocky slopes (center of block diagram). Delineations are mainly in the Bridger Range, northern Absaroka-Beartooth Range, southern Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of rock outcrop and soils. Soils are moderately coarse to medium textured. They have formed in material weathered from limestone and sandstone. Native vegetation is timberline forest and alpine meadows.

ADJOINING M.U. Adjacent units have steep slopes with little vegetation or gentle slopes with dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	7,800-8,800	40-60

The unit consists of steep rocky slopes. Avalanche paths and rock slides are common on these slopes. Bedrock exposures form cliffs and ledges. Bouldery talus slopes are often found below these bedrock exposures. Scree is common at the base of steep slopes. These slopes are dissected by well defined intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms are stable but slope unraveling and local sedimentation can occur. They have moderate subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of rock outcrop, talus, and scree - 40 to 60 percent; subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 25 to 35 percent; and Idaho fescue/tufted hairgrass (FEID/DECA) - 10 to 20 percent. Included HTs with dissimilar management implications are subalpine fir (ABLA) habitat types that have closed forest canopies - 5 percent.

HABITAT TYPE DISTRIBUTION ALBA-PIAL/VASC occurs as isolated forest stands or stringers. An included similar HT at higher elevations is whitebark pine - subalpine fir (PIAL-ABLA). Cold climates and very low timber productivity are associated with these HTs. FEID/DECA occupies the alpine meadows. Cold climates and moderately productive range sites are associated with this HT.

Included are up to 5 percent dissimilar HTs. Subalpine fir (ABLA) HTs are in shallow draws and at the base of slopes. These HTs are more productive timber sites.

EXISTING VEGETATION consists of open grown whitebark pine and subalpine fir forest scattered among areas of rock outcrop and scree. Trees in these stands are often deformed and stunted. The forest understory is composed of a sparse mat of shrubs dominated by grouse whortleberry. Forbs such as lupine are common. Alpine meadows are composed of a variety of grasses and forbs which are rarely over 6 inches in height. Idaho fescue, tufted hairgrass, bearded wheatgrass, alpine bluegrass, and sedges are common.

GEOLOGY

OCCURRENCE The unit is underlain by limestone - 80 percent; sandstone and hard crystalline rocks - 20 percent.

The bedrock consists of thick beds of limestone of Paleozoic age. Typically they are from the Madison or older groups. Included are some calcareous sandstones and thinly bedded shales which are similar.

Included bedrock with dissimilar properties are quartzitic sandstone or hard crystalline rocks. Weathering products from these rocks are coarse textured. Most of the sandstone areas are near Gardiner.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, and moderately coarse to medium textured. Subsoils contain greater than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of rock outcrop and soils. Rock outcrop and talus are distributed over 40 to 60 percent of the unit. Soil properties vary with vegetation. Soils with light colored surface layers are in forested areas or near limestone exposures. Included similar soils as of shallow or have subsoil clay accumulations. These soils occupy 20 to 40 percent of the unit. Soils with dark colored surface layers are in alpine meadows. Included are similar soils with subsoil clay accumulations. These soils occupy 10 to 20 percent of the unit.

GENERAL DESCRIPTION The soils with light colored surface layers have brown cobbly loam surface layers about 7 inches thick. Subsoils are very pale brown very cobbly loam or sandy laom about 13 inches thick. The substratum, a very pale brown, very cobbly loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil description 21 is representative of some soils in this unit. Soils vary from one area to another.

The soils with dark colored surface layers have dark grayish brown cobbly silt loam or loam surface layers about 8 inches thick. Subsoils are dark grayish brown very cobbly silty clay loam or loam about 8 inches thick. The substratum, a grayish brown very cobbly loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil descriptions 14 and 17 are representative of some soils in this unit. Soils vary from one area to another.

CLASSIFICATION REMARKS The soils with light colored surface layers are Cryochrepts. The most common subgroups are Typic Cryochrepts and Lithic Cryochrepts. The similar included soils soils with subsoil clay accumulations are Cryoboralfs. Soils with dark colored surface layers are Cryoborolls. The most common subgroups are Typic Cryoborolls and Argic Cryoborolls.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is less than 20 cu. ft./acre.

ROADS The unit is poorly suited to road construction. Hard, non-rippable bedrock severely limits excavation, and slope steepness increases the quantity of material excavated. Native road surfaces are rough. Material exposed by road construction is difficult to revegetate. Special revegetation practices can be necessary to reestablish vegetation. Avalanches create a maintenance problem and a hazard for winter travel.

RANGE The unit is poorly suited to range management. The potential native plant community in alpine meadows produces about 1,305 pounds per acre of dry herbage in normal years. Steep slopes and rock outcrop limit access by livestock. Grazing seasons are short. The forest understory provides little forage. The unit is poorly suited for use as transitional range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall grizzly bear habitat. There is also potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat nor does it border streams containing habitat.

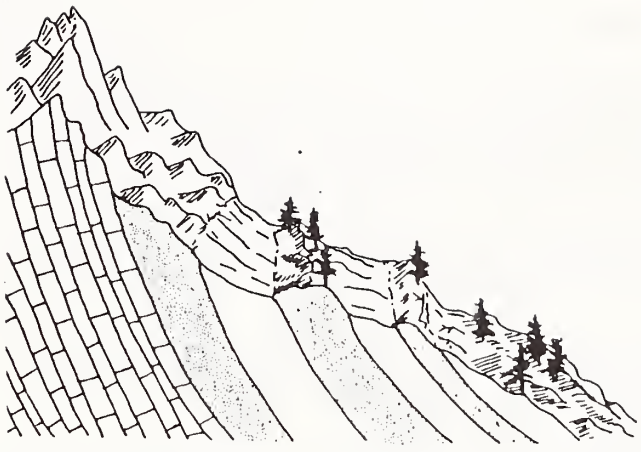
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	high
Sediment Delivery Efficiency	moderate
Timber Productivity	very low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	26-60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-1B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the western Bridger Range, the northern Gallatin Range, and northeast of Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured with dark colored surface layers. They have formed in material weathered from limestone, sandstone, and shale. Native vegetation is grassland with some Douglas-fir forest.

ADJOINING M.U. Adjacent units have dense Douglas-fir or lower subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	5,800-7,800	15

The unit consists of ridges with steep slopes and occasional small valleys or swales The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone or limestone which is often exposed on ridgetops and the steepest slopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have low subsurface water storage capacity and most surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and big sagebrush/Idaho fescue (ARTR/FEID) - 75 percent. An included HT with dissimilar management implications is Douglas-fir/snowberry (PSME/SYAL) - 10 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic pattern throughout the unit. A similar HT, Douglas-fir/Idaho fescue (PSME/FEID), is found near dense forest stands. Warm climates and moderately productive range sites are associated with these HTs.

Included are up to 10 percent of the dissimilar HT PSME/SYAL. This HT is in densely forested areas.

EXISTING VEGETATION is a mosaic of mountain grassland and shrubland with some dense Douglas-fir forest. The grassland contains abundant Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrubland contains big sagebrush with Idaho fescue and common forbs dominating the understory. The included forest understory is composed of shrubs. Douglas-fir seedlings frequently invade these grasslands and shrublands.

GEOLOGY

OCCURRENCE The unit is underlain by limestone - 80 percent; sandstone and hard crystalline rocks - 20 percent.

The bedrock consists of thick beds of limestone of Paleozoic age. Typically they are from the Madison or older groups. Included are similar calcareous sandstones and thinly bedded shales.

Included bedrocks with dissimilar properties are quartzitic sandstone or hard crystalline rocks. These rocks weather to form coarser textured more erodible material. Most areas of sandstone are near Gardiner.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, and medium to moderately fine textured. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Soil properties vary with parent material. Soils formed in material weathered from limestone have dark colored surface layers and strongly calcareous subsoils. Vegetative cover is sparse in these areas. These soils occupy 40 percent of the unit. Soils formed in material weathered from sandstone and shale have dark colored surface layers and calcareous subsoils. Included on lower slopes are similar soils with very thick dark surface layers. These soils occupy 30 percent of the unit.

Included are up to 15 percent dissimilar soils. These soils have light colored surface layers and are in forested areas or near rock outcrops.

GENERAL DESCRIPTION The soils with strongly calcareous subsoils have dark grayish brown, very gravelly silt loam surface layers about 11 inches thick. Subsoils are pale brown, very gravelly loam about 8 inches thick. The substratum, a very pale brown, extremely cobbly loam, overlies bedrock at depths of more than 5 feet. This soil is calcareous to within a few inches of the surface. See soil description 13 for more detail.

The soils with noncalcareous subsoils have very dark grayish brown, silt loam surface layers about 8 inches thick. Subsoils are light yellowish brown, very gravelly silt loam about 8 inches thick. The substratum, a light yellowish brown, very cobbly silt loam, overlies bedrock at depths of more than 5 feet. This soil is calcareous below a depth of 18 inches. See soil description 10 for more detail.

CLASSIFICATION REMARKS The soils with strongly calcareous subsoils are Typic Calciborolls, loamy skeletal, carbonatic. The soils with calcareous subsoils are Typic Argiborolls, loamy skeletal, mixed. Included similar soils are Pachic Argiborolls, loamy skeletal, mixed.

The included dissimilar soils are Mollic Eutroboralfs, loamy skeletal, mixed; and Typic Ustochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. It is primarily mountain grassland and shrubland with scattered forest stands.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation. Steep slopes increase the quantity of material excavated. The material exposed by road construction is erodible and difficult to revegetate. Special revegetation practices can be necessary to reestablish vegetation.

RANGE The unit is moderately suited to range management. The potential native plant community produces from 1,245 - 1,405 pounds per acre of air dry herbage in normal years. Steep slopes, rock outcrop, and lack of water severely limit access by livestock. Drift fences, herding and salting away from water help overcome these limitations.

WILDLIFE-FISHERIES The unit is potentially fair fall and winter mule deer and elk habitat. Fair blue grouse spring and summer habitat is also available. There is potentially good nesting habitat for cliff nesting raptors. The unit does not normally contain trout habitat nor does it border streams containing habitat.

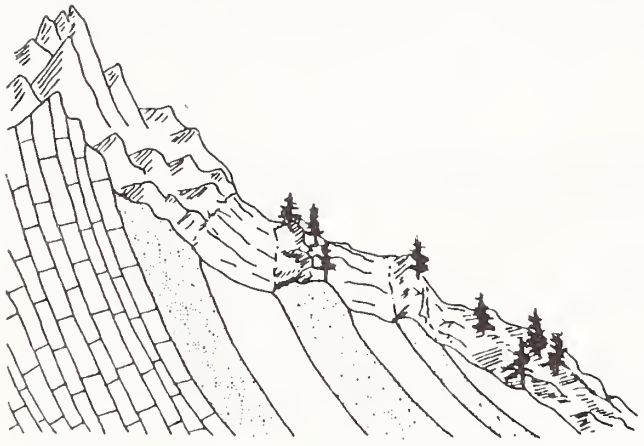
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	none
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	15-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March-April
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-1D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the Bridger Range, northern Absaroka-Beartooth Range, the northern and central Gallatin Range, the southern Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium to moderately fine textured with light colored surface layers. They have formed in materials weathered from limestone and sandstone. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have dense subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Variable	6,700-7,500	20

The unit consists of ridges with steep slopes and occassional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by limestone or sandstone which is often exposed on ridgetops and steep sideslopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have low subsurface water storage capacities and surface runoff occurs during snow melt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL), subalpine fir/twin flower (ABLA/LIBO) and subalpine fir/virgin's bower (ABLA/CLPS) - 75 percent. Included dissimilar HTs are Douglas-fir (PSME) or Engelmann spruce (PIEN) HTs with shrubby understory unions and Idaho fescue/tufted hairgrass (FEID/DECA) - 5 percent.

HABITAT TYPE DISTRIBUTION The major HTs ABLA/VAGL and ABLA/LIBO are at low to mid-elevations while ABLA/CLPS is at upper elevations. An included similar HT is subalpine fir/grouse whortleberry (ABLA/VASC). Cool moist climates and low timber productivity are associated with these HTs.

Included are up to 5 percent dissimilar HTs. PSME and PIEN are on drier sites and along drainage ways respectively. PSME is less productive and PIEN is more productive. FEID/DECA is in meadows.

EXISTING VEGETATION consists of dense lodgepole pine forest. Forest understories are composed of dense mats of blue huckleberry, twinflower, or virgin's bower. Douglas fir or Engelmann spruce forests are at lower elevations. A few mountain meadows are on upper slopes.

GEOLOGY

OCCURRENCE The unit consists of limestone - 80 percent; sandstone and hard crystalline rocks - 20 percent.

The bedrock consists of thick beds of Paleozoic age limestone from the Madison or older groups. Included are calcareous sandstones and thinly bedded shales which are similar.

Included bedrock with dissimilar properties are quartzitic sandstone or hard crystalline rocks. These rocks weather to form coarse textured more erodible material. Most areas of sandstone are near Gardiner.

SOILS

GENERAL NATURE OF SOILS Soils are well to somewhat excessively drained with light colored surface layers and medium to moderately fine textures. Subsoils contain more than 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of medium to moderately fine textured soils and rock outcrop. Rock outcrop and talus occupy 20 percent of the unit near ridgetops and on very steep slopes. Soil properties vary with vegetation and aspect. Soils with little subsoil clay accumulation and medium textures occur where bedrock is close to the surface or under open canopied timber stands. Some of these soils may have concentrations of calcium carbonate in the substratum. Included are similar soils that are shallow or have acid subsoils. These included soils are near sandstone outcrops. They occupy 45 percent of the unit. Soils with subsoil clay accumulation and moderately fine textures are under dense forest canopies and on northern exposures. These soils occupy 30 percent of the unit.

Included are up to 5 percent dissimilar soils in mountain meadows. These soils have dark colored surface layers.

GENERAL DESCRIPTION The medium textured soils have brown, silt loam surface layers about 7 inches thick. Subsoils are very pale brown, very cobbly silt loam or loam about 13 inches thick. The substratum, a light gray, very cobbly loam or sandy loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 21 for more detail.

The moderately fine textured soils have very pale brown gravelly silt loam surface layers about 11 inches thick. Subsoils are light brown, very cobbly silty clay loam about 12 inches thick. The substratum, a very pale brown, very cobbly sandy clay loam, overlies bedrock at depths of 2 to more than 5 feet. See soil description 4 for more detail.

CLASSIFICATION REMARKS The medium textured soils are Typic Cryochrepts, loamy skeletal, mixed. Similar included soils are Lithic Cryochrepts, loamy skeletal, mixed; or Dystric Cryochrepts, loamy skeletal, mixed. The moderately fine textured soils are Typic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar meadow soils are Argic Cryoborolls, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 40 to 52 cu. ft./acre. Steep slopes severely limit equipment operation. Cable yarding systems help overcome this limitation. Moisture stress and competition moderately limit regeneration. Planting and immediate site preparation after harvest help overcome these limitations. Designing cutting units for maximum snow retention can also help.

ROADS The unit is poorly suited to road construction. Non-rippable bedrock severely limits excavation, and steep slopes increase the quantity of material excavated. Native road surfaces are rough. Material exposed by road construction is difficult to revegetate. Special practices can be necessary to reestablish vegetation.

RANGE The unit is poorly suited to range management. The forest understory provides little forage. The unit is poorly suited for use as transitory range.

WILDLIFE-FISHERIES The unit is potentially fair summer mule deer habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

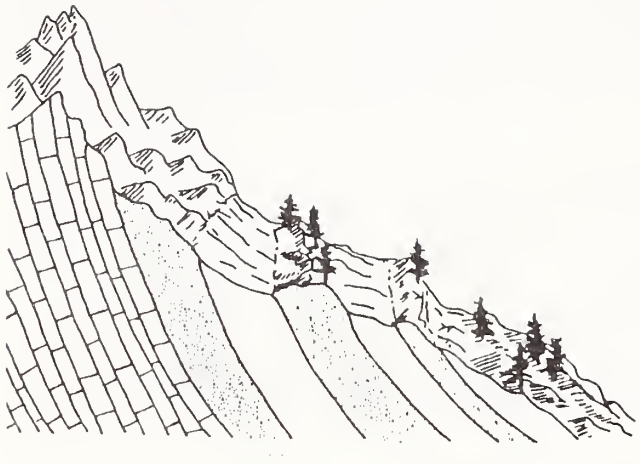
INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	April-May
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the Gallatin and Bridger ranges with some in the southern Madison Range.

M.U. COMPONENTS This unit contains an association of soils. Soils are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is open grown Douglas-fir forest and mountain grassland.

ADJOINING M.U. Adjacent units are entirely mountain grassland or dense subalpine forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Southern	5,800-7,800	10

The unit consists of ridges with steep slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops. Small valleys and swales are underlain by shale, siltstune, or mudstune. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic to rectangular pattern with steep channel gradients. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have moderate subsurface water storage capacity and surface runoff occurs occasionally.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/Idaho fescue (PSME/FEID) - 50 percent; and Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 25 percent. An included HT with dissimilar management implications is Douglas-fir/snowberry (PSME/SYAL) - 15 percent.

HABITAT TYPE DISTRIBUTION PSME/FEID and FEID/AGSP form a mosaic throughout the unit. Limber pine (PIFL) HTs with grassy understories and big sagebrush/Idaho fescue (ARTR/FEID) are similar included HTs. Warm dry climates and low timber productivity are associated with these HTs.

Included are small areas of the dissimilar HT PSME/SYAL on northern exposures. THis HT is on more productive timber sites. This HT occupies up to 15 percent uf the unit.

EXISTING VEGETATION is a mosaic of open grown Douglas-fir forest and mountain grassland. Forest trees are stunted and the understory is composed of Idaho fescue and bluebunch wheatgrass. Mountain grasslands consist of Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. Occasionally, big sagebrush forms a dense overstory in these grasslands. Douglas-fir seedlings are often found invading the grasslands.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. This bedrock is upper Cretaceous through Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with muderately fine textures and subsoil clay accumulation. Subsoils contain 3-20 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains an association of soils. Soil properties vary with vegetation and bedrock. Soils formed under open grown Douglas-fir forests have thin dark colored surface layers. Included are similar soils with light colored surface layers. These soils occupy 50 percent of the unit. Soils formed under mountain grassland have dark colored surface layers. Included are similar soils with more than 35 percent subsoil rock fragments which are underlain by sandstone. These soils occupy 30 percent of the unit.

Included are up to 10 percent dissimilar medium textured soils with more than 35 percent subsoil rock fragments. These soils are on less productive timber and range sites.

GENERAL DESCRIPTION The soils with thin, dark colored surface layers have dark grayish brown, loam surface layers about 6 inches thick. Subsoils are variably colored, gravelly clay loams about 22 inches thick. The substratum, a variably colored clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown, silt loam surface layers about 8 inches thick. Subsoils are variably colored clay loams about 15 inches thick. The substratum, a variably colored gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with thin, dark colored surface layers are Mollic Cryoboralfs, fine loamy, mixed. Similar soils are Typic Cryoboralfs, fine loamy, mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. Similar soils are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Small areas of timber on northern exposures occupy 15 percent of the unit but produce over 90 percent of the timber. The potential annual production of these areas is 48 to 64 cu. ft./acre. Steep slopes limit equipment operation. Cable yarding systems can overcome this limitation. Moisture stress and competition moderately limit forest regeneration to years when seed production is good and precipitation is above average. Use of shelterwood and group selection silvicultural systems improve regeneration success. Immediate site preparation and planting after harvest can also help.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly. Slope stability should be evaluated before planning and locating roads. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is moderately suited to range management. The mountain grassland component occupies about 25 percent of the unit but produces over 60 percent of the available forage. The potential annual production in these areas is about 1,245 pounds per acre of air dry herbage in normal years. Timothy has invaded some grasslands. This may alter grazing seasons and affect utilization. Slope steepness and water availability severely limit accessibility. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome this limitation. Douglas-fir forests on southern exposures provide some useable forage. After timber harvest, forage production increases. These areas can be used as transitory range.

WILDLIFE-FISHERIES The unit is potentially good summer and fall mule deer and fall elk habitat. Good summer blue grouse habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

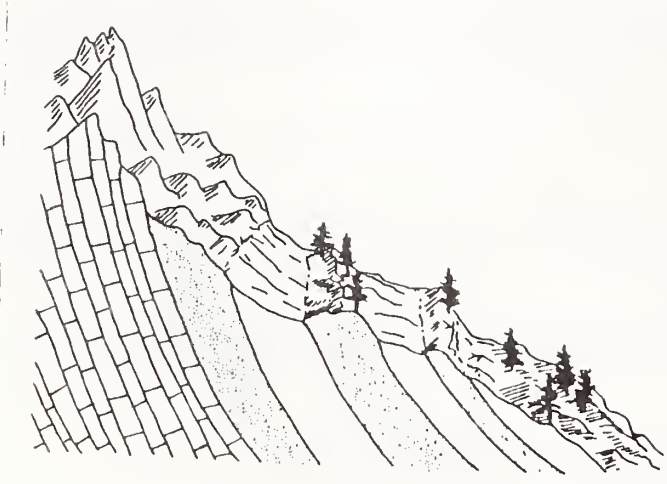
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	very low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	high
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-40
Spring Runoff	March-May
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the Gallatin and Bridger Ranges with some in the southern Madison Range, and western Crazy Mountains.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are moderately fine and medium textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is lower subalpine and Douglas-fir forest with scattered mountain grasslands.

ADJOINING M.U. Adjacent units are entirely mountain grassland or Douglas-fir forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	6,500-7,500	15

The unit consists of ridges with steep slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a dendritic to rectangular pattern with steep channel gradients. These landforms have moderate landslide hazards in 20-40 percent of the unit. They have moderate subsurface water storage capacity and surface runoff occurs occasionally. Runoff may transport eroded material to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Douglas-fir/snowberry (PSME/SYAL) and Douglas-fir/ninebark (PSME/PHMA) - 45 percent; and subalpine fir/blue huckleberry (ABLA/VAGL) and subalpine fir/grouse whortleberry (ABLA/VASC) - 25 percent. Included HTs with dissimilar management implications are Douglas-fir and limber pine (PIFL) HTs with grassy understory unions - Idaho fescue/bluebunch wheatgrass (FEID/AGSP) - 15 percent.

HABITAT TYPE DISTRIBUTION PSME/SYAL and PSME/PHMA are at lower elevations, and ABLA/VAGL and ABLA/VASC are at upper elevations. Included similar HTs at upper elevations are subalpine fir/pinegrass (ABLA/CARU) and subalpine fir/virgin's bower (ABLA/CLPS). Cool moist climates and moderately productive timber sites are associated with these HTs.

Included are up to 15 percent dissimilar HTs. Douglas-fir and limber pine with grassy understories are on southern exposures. These HTs are on less productive timber sites. FEID/AGSP occurs in small scattered mountain grassland parks.

EXISTING VEGETATION consists of dense lodgepole pine forests at upper elevations and Douglas-fir forests at lower elevations. Small areas of mountain grassland are scattered throughout these forests. The forest understory is composed of a thick mat of shrubs dominated by blue huckleberry and grouse whortleberry at upper elevations, and snowberry and ninebark at lower elevations. The mountain grasslands are dominated by Idaho fescue, bluebunch wheatgrass and common forbs. Bearded wheatgrass, mountain brome and timber oatgrass are common in moist areas.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone, shale, mudstone or siltstone. This bedrock is upper Cretaceous through Triassic in age. The most common geologic formations are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine and medium textures and subsoil clay accumulations. Subsoils contain 15 to 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex pattern of soils and rock outcrop. Rock outcrop occupies 15 percent of the unit on ridges. Soil properties vary with vegetation and bedrock characteristics. Soils formed under dense forests have light colored surface layers and are moderately fine textured. Included are similar soils with more subsoil rock fragments and soils with somewhat dark colored surface layers. These soils occupy 50 percent of the unit. Soils formed in weathering products from hard sandstone have light colored surface layers and more subsoil rock fragments. They occupy 25 percent of the unit.

Included are up to 15 percent dissimilar soils. These soils have dark colored surface layers. They are under open grown Douglas-fir or limber pine forest or mountain grassland vegetation. The forested areas are less productive timber sites.

GENERALIZED DESCRIPTION The soils with light colored surface layers under dense forest have very pale brown loam surface layers about 9 inches thick. Subsoils are light yellowish brown, clay loam about 23 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 3 for more detail.

The soils formed in material weathered from hard sandstone have brown, gravelly loam surface layers about 7 inches thick. Subsoils are very pale brown, cobbly sandy loam about 13 inches thick. The substratum, a very pale brown, very cobbly sandy loam, overlies bedrock at depths of 2 to greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. Similar soils are Typic Cryoboralfs, loamy skeletal, mixed and Mollic Cryoboralfs, fine loamy, mixed. The soils formed in material weathered from hard sandstone are Typic Cryochrepts, loamy skeletal, mixed.

The included dissimilar soils are Argic Cryoborolls, loamy skeletal, mixed. Occasionally, Montmorillonitic families are found in soil materials weathered from shale. Most soil families are mixed, however.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. Potential annual production is 48 to 71 cu. ft./acre. Steep slopes severely limit equipment operation. Cable yarding systems can overcome this limitation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides. Regeneration is slightly limited by moisture stress and competition. Shelterwood and group selection silvicultural systems can improve regeneration success. Site preparation and planting can also help.

ROADS The unit is moderately suited to road construction. Unstable slopes occur commonly in moist drainageways. Slope stability should be evaluated before plannong and locating roads. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is poorly suited to range management. Forest understories provide little forage.

WILDLIFE-FISHERIES The unit is potentially good fall elk habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

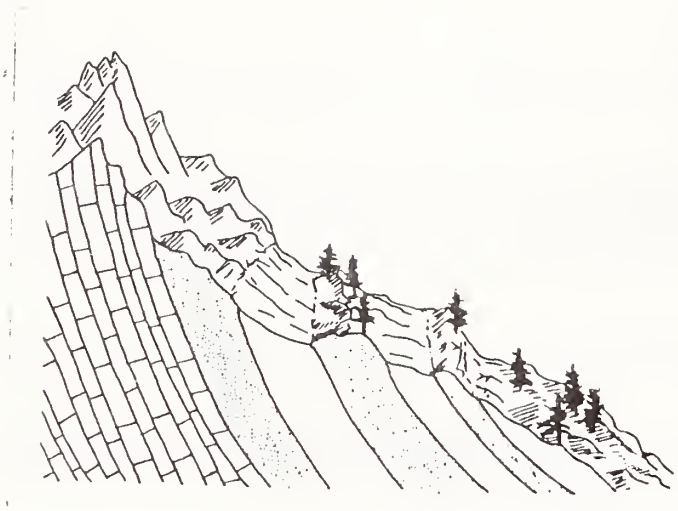
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	low
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-35
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Lengtn of Frost Free Season (days)	50-90
Potential Evapotranspiration	low
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-2C

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the northwestern Bridger Range, the northwestern Crazy Mountains, the northern Absaroka-Beartooth Range, the Gallatin Range, and the southeast Madison Range.

M.U. COMPONENTS The unit contains a complex of medium to moderately fine textured soils with dark colored surface layers. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is mountain grassland and shrubland and Douglas-fir forest.

ADJOINING M.U. Adjacent units are entirely dense Douglas-fir or subalpine forest vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45 +	Southern	6,500-7,500	10

The unit consists of ridges with steep slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone or limestone which is often exposed on ridgetops or steep slopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock. The land surface often conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have moderate landslide hazards on dip slopes. They have moderate subsurface water storage capacity and surface runoff occurs occasionally.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of Idaho fescue/bluebunch wheatgrass (FEID/AGSP) and big sagebrush/Idaho fescue (ARTR/FEID) - 60 percent; and Douglas-fir/snowberry (PSME/SYAL) - 25 percent. Included HTs with dissimilar management implications are subalpine fir (ABLA) HTs with shrubby understory unions - 5 percent.

HABITAT TYPE DISTRIBUTION FEID/AGSP and ARTR/FEID occur in a mosaic throughout the unit. An included similar HT, Idaho fescue/bearded wheatgrass (FEID/AGCA) is in depressions. Warm dry climates and moderately productive range sites are associated with these HTs. PSME/SYAL occurs in scattered forest stands throughout the unit. Warm moist climates and low timber productivity are associated with this HT.

Included are small areas of dissimilar HTs. ABLA HTs occupy scattered forest stands at upper elevations. Cool moist climates and moderate timber productivity are associated with these HTs.

EXISTING VEGETATION is a mosaic of mountain grassland and shrubland with scattered stands of dense Douglas-fir forest. The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass and common forbs. The shrubland has a canopy of big sagebrush with an understory of Idaho fescue and common forbs. Sticky geranium, bearded wheatgrass, mountain brome and timber oatgrass are common on moist sites.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, siltstone and occasionally limestone. This bedrock is upper Cretaceous through Triassic in age. The most common geologic formations associated with this group are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, with medium to moderately fine textures, subsoil clay accumulation, and dark colored surface layers. Subsoils contain 10-35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with topography and vegetation. Soils with dark colored surface layers occur under grassland vegetation throughout the unit. Included are similar soils with very thick dark surface layers in swales and other depressional areas. These soils occupy 40 percent of the unit. Soils with dark colored surface layers and more subsoil rock fragments are on rounded ridgetops and in some forested areas. They occupy 25 percent of the unit.

Included are up to 25 percent dissimilar soils. Soils with light colored surface layers and more subsoil rock fragments are in forested areas. Also included are moderately coarse textured soils with light colored surface layers and more subsoil rock fragments. These soils are on ridge tops near sandstone outcrops. These soils are on less productive range sites.

GENERAL DESCRIPTION The soils with dark colored surface layers and few subsoil rock fragments have grayish brown silt loam surface layers about 8 inches thick. Subsoils are light yellowish brown clay loam. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material color. See soil description 16 for more detail.

The soils with dark colored surface layers and more subsoil rock fragments have brown gravelly loam surface layers about 7 inches thick. Subsoils are pale borwn very gravelly clay loam about 12 inches thick. The substratum, a light yellowish brown, very gravelly loam or clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material color. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils with dark colored surface layers and few subsoil rock fragments are Argic Cryoborolls, fine loamy, mixed. The included similar soils are Argic Pachic Cryoborolls, fine loamy, mixed. The soils with dark colored surface layers and more subsoil rock fragments are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryoboralfs, loamy skeletal, mixed; and Typic Cryochrepts, loamy skeletal, mixed. Occasionally Montmorillonitic families are found in soil materials weathered from shale. Most soil families are mixed, however.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Scattered stands of Douglas-fir forest occupy 25 percent of the unit but produce over 90 percent of the timber. The potential annual production of these stands is 36 to 48 cu. ft./acre. Steep slopes severely limit equipment operation. Cable yarding systems can overcome this limitation. Regeneration is moderately limited by moisture stress and competition. regeneration. Shelterwood and group selection silvicultural systems can improve regeneration success. Site preparation, and planting can also help.

ROADS The unit is moderately suited to road construction. Slope steepness increases the quantity of material excavated. Unstable slopes occur commonly on dip slopes where ground water is concentrated. Slope stability should be evaluated before planning and locating roads. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is moderately suited to range management. The potential annual production is from 1,634 to 1,820 pounds per acre of air dry herbage in normal years in the mountain grasslands and shrublands. Timothy has invaded some areas. This may alter grazing seasons and affect utilization. Slope steepness and water availability severely limit accessibility. Livestock tend to concentrate on less sloping areas. Drift fences, herding and salting away from water help overcome this limitation. The forest understory provides little forage. Timber harvest can increase forage production.

WILDLIFE-FISHERIES This unit is potentially good summer and fall mule deer and fair fall and winter elk habitat. Fair summer blue grouse habitat is also available. The unit does not normally contain trout habitat nor does it border streams containing habitat.

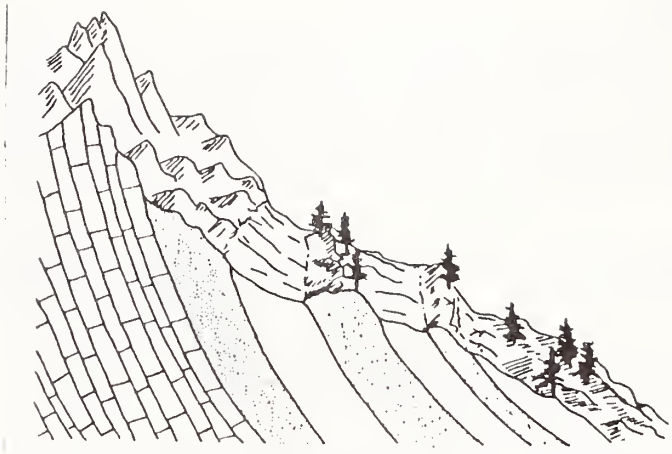
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	low
Sediment Delivery Efficiency	moderate
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	moderate

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	20-30
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	10-25
Spring Runoff	March
Length of Frost Free Season (days)	90-120
Potential Evapotranspiration	high
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-2D

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the Gallatin Range, Bridger Range, and southern Madison Range, with some in the Absaroka-Beartooth Range.

M.U. COMPONENTS This unit contains a complex of soils. Soils are moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have either mountain grassland or Douglas-fir forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45+	Northern	6,500-8,000	10

The unit consists of ridges with steep slopes and occasional small valleys or swales. The shape of these landforms is strongly controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone which is often exposed on ridgetops. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock, but the land surface seldom conforms to bedrock dip. These slopes are dissected by poorly defined, intermittent streams. The drainage system has a dendritic to rectangular pattern with steep channel gradients. These landforms have moderate landslide hazards in over 40 percent of the unit. They have moderate subsurface water storage capacity and surface runoff occurs occasionally. Runoff can transport eroded material to stream channels.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine-fir/heartleaf arnica (ABLA/ARCO) and subalpine fir/blue huckleberry (ABLA/VAGL) - 80 percent. Included HTs with dissimilar management implications are Douglas-fir (PSME) HTs with shrubby understory unions - 10 percent.

HABITAT TYPE DISTRIBUTION ABLA/ARCO and ABLA/VAGL are on upper slopes. A variety of subalpine fir (ABLA) or Engelmann spruce (PIEN) HTs with shrubby or grassy understory unions are included and considered similar. Cool moist climates and moderate timber productivity are associated with these HTs.

Included are up to 10 percent dissimilar HTs. The PSME HTs are at lower elevations and require different silvicultural treatment.

EXISTING VEGETATION consists of dense lodgepole pine and subalpine fir forest. Engelmann spruce occupies moist drainageways and whitebark pine is at upper elevations. Dense Douglas-fir forest is at lower elevations. The forest understory is composed of a variety of forbs and shrubs including heartleaf arnica, blue huckleberry, grouse whortleberry, and twinflower. Ninebark often occurs under Engelmann spruce.

GEOLOGY

OCCURRENCE The unit is underlain by interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, or siltstone. This bedrock is upper Cretaceous through Triassic in age. The most common geologic formations associated with this group are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with moderately fine textures and subsoil clay accumulations. Subsoils contain 35-50 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties are not obviously associated with unique landscape features. Some major soils have thin, dark colored surface layers. Included are similar soils with fewer subsoil rock fragments. These soils occupy 50 percent of the unit. Other major soils have light colored surface layers. These soils occupy 25 percent of the unit.

Included are up to 15 percent dissimilar soils. Soils with light colored surface layers and no subsoil clay accumulation are near sandstone outcrops. Also included at lower elevations and near mountain meadows are soils with dark colored surface layers. Both soils are on less productive timber sites.

GENERAL DESCRIPTION The soils with thin, dark colored surface layers have dark grayish brown, very gravelly loam surface layers about 6 inches thick. Subsoils are pale brown, very cobbly clay loam about 29 inches thick. The substratum, a very pale brown, very cobbly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. The subsoil and substratum are variably colored because of variably colored parent materials. See soil description 7 for more detail.

The soils with light colored surface layers have very pale brown, gravelly loam surface layers about 11 inches thick. Subsoils are pale brown cobbly clay loam about 12 inches thick. The substratum, a very pale brown very cobbly loam, overlies bedrock at depths of 2 to greater than 5 feet. Subsoil and substratum colors are variable because of variably colored parent materials. See soil description 4 for more detail.

CLASSIFICATION REMARKS The soils with thin, dark colored surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. Similar soils are Mollic Cryoboralfs, fine loamy, mixed. The soils with light colored surface layers are Typic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal mixed and Cryoborolls in several great groups.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. The potential annual production is 52 to 80 cu. ft./acre. Steep slopes severely limit equipment operation. Cable yarding systems can overcome this limitation. The forest helps stabilize unstable slopes. Timber harvest can increase the risk of landslides.

ROADS The unit is poorly suited to road construction. Unstable slopes occur frequently. Slope stability should be evaluated before planning and locating roads. Slope steepness increases the quantity of material excavated. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation. Roads need suitable subgrade material because of low strength and seasonal wetness.

RANGE The unit is poorly suited to range management. Steep slopes and lack of forage severely limit use. The forest understory can provide some transitory range in some areas following timber harvest.

WILDLIFE-FISHERIES The unit is potentially good summer elk and grizzly bear habitat. Good summer and fall moose habitat is also available. The unit does not normally contain trout habitat but borders streams that do.

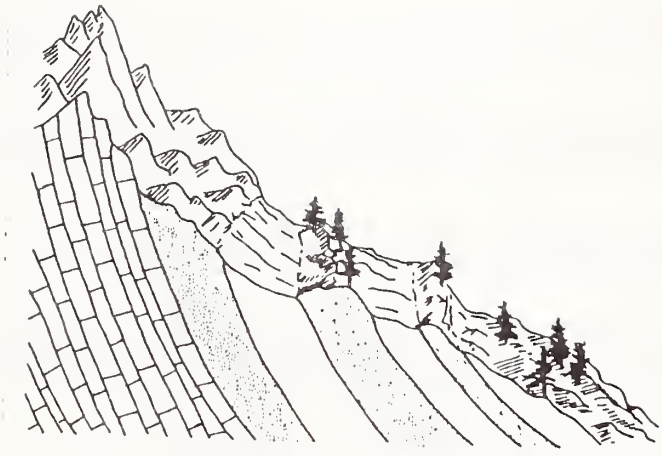
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	moderate
Timber Productivity	moderate
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-40
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	26-60
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	low
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 87-2E

MAP UNIT SUMMARY

M.U. SETTING The landform consists of steep, structurally controlled slopes (block diagram). Delineations are mainly in the Bridger Range, the southern Madison Range, and north of Hebgen Lake.

M.U. COMPONENTS The unit contains a complex of soils and rock outcrop. Soils are medium and moderately fine textured. They have formed in material weathered from thickly bedded sandstone and shale. Native vegetation is upper subalpine forest, mountain meadows and alpine meadows.

ADJOINING M.U. Adjacent units have gently rolling slopes with forest vegetation or steep, structurally controlled slopes with little vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
45 +	Variable	8,000-8,800	20

The unit consists of ridges with steep slopes and occasional small valleys or swales. The shape of these landforms controlled by the underlying interbedded bedrock. Ridges are generally underlain by sandstone or limestone which is often exposed on ridgetops or steep slopes. Small valleys and swales are underlain by shale, siltstone, or mudstone. Landscapes can be complex depending upon the bedding characteristics of the underlying rock. The land surface often conforms to bedrock dip. These slopes are dissected by well defined, intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have moderate landslide hazards in over 40 percent of the unit. They have moderate subsurface water storage capacity and surface runoff occurs occasionally.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 40 percent and Idaho fescue/tufted hairgrass (FEID/DECA) - 20 percent. Included HTs with dissimilar management implications are subalpine fir/heartleaf arnica (ABLA/ARCO) and subalpine fir/virgin's bower (ABLA/CLPS) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA-PIAL/VASC is on steeper slopes and is often underlain by sandstone. An included similar HT is whitebark pine-subalpine fir (PIAL-ABLA) at upper elevations. Cold moist climates and very low timber productivity are associated with these HTs. FEID/DECA is in small valleys and swales and is often underlain by shale. Cold moist climates and highly productive range sites are associated with this HT.

Included are up to 20 percent dissimilar HTs. ABLA/ARCO and ABLA/CLPS are at lower elevations on more productive timber sites.

EXISTING VEGETATION consists of stunted lodgepole pine, whitebark pine, subalpine fir and Engelmann spruce forest intermixed with scattered mountain and alpine meadows. The forest understory is composed of a moderately dense mat of shrubs, forbs and sedges dominated by grouse whortleberry, heartleaf arnica and elk sedge. Meadows are composed of short grasses, forbs and sedges. The most common grasses are tufted hairgrass, bearded wheatgrass, mountain brome, timber oatgrass, alpine bluegrass, and several fescue species.

GEOLOGY

OCCURRENCE The unit consists of interbedded shale, siltstone, and sandstone - 100 percent.

The bedrock consists of thick beds of light colored sandstone shale, mudstone, siltstone, and occasionally limestone. This bedrock is upper Cretaceous through Triassic in age. The most common geologic formations associated with this group are Telegraph Creek, Cody, Mowry-Thermopolis, Kootenai, Morrison, and formations of the Ellis group. The Albino formation occurs locally in the Madison and southern Gallatin Range.

Included bedrock with dissimilar properties is light colored quartzitic sandstone of the Quadrant formation. Weathering products from this bedrock are more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium to moderately fine textures. Subsoils contain 10 to 35 percent rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils and rock outcrop. Rock outcrop commonly occupies 20 percent of the unit. This exposed bedrock is often on ridges. Soil properties vary with vegetation and bedrock characteristics. Soils with somewhat darkened surface layers overlie shale bedrock and support forest vegetation. Included are similar soils with light colored surface layers, finer subsoil textures or more subsoil rock fragments. These soils occupy 40 percent of the unit. Soils with dark colored surface layers are in meadows. Similar included soils have thick dark colored surface layers. These soils occupy 30 percent of the unit.

Included are up to 15 percent dissimilar soils with moderately coarse textures and more subsoil rock fragments. These soils overlie Quadrant sandstone and are more erodible.

GENERAL DESCRIPTION The soils with somewhat darkened surface layers have light brownish gray loam surface layers about 14 inches thick. Subsoils are light yellowish brown clay loam or silty clay loam about 22 inches thick. The substratum, a pale brown clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colores are variable because of variable parent material colors. See soil description 6 for more detail.

The soils with dark colored surface layers have grayish brown silt loam surface layers about 8 inches thick. Subsoils are light yellowish brown clay loam about 15 inches thick. The substratum, a light yellowish brown gravelly clay loam, overlies bedrock at depths of 2 to greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 16 for more detail.

CLASSIFICATION REMARKS The soils with somewhat darkened surface layers are Mollic Cryoboralfs, fine loamy, mixed. The included soils with light colored surface layers are Typic Cryoboralfs, fine loamy, mixed. The soils with finer subsoil textures are Mollic Cryoboralfs, fine, mixed and the soils with more subsoil rock fragments are Mollic Cryoboralfs, loamy skeletal mixed. The soils with dark colored surface layers are Argic Cryoborolls, fine loamy, mixed. The similar included soils are Argic Pachic Cryborolls, fine loamy, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is poorly suited to timber management. Potential annual production is less than 20 cu. ft./acre. Steep slopes severely limit equipment operation. Cable yarding systems help overcome this limitation. Harsh climate and moisture stress severely limit regeneration. Trees are often widely spaced, stunted and poorly formed.

ROADS The unit is poorly suited to road construction. Hard nonrippable bedrock limits excavation. Slope steepness increases the quantity of material excavated. Unstable slopes occur frequently. Snow cover limits season of use. Slope stability should be evaluated before planning and locating roads. Unsurfaced roads become rutted when wet and dusty when dry. Surfacing or seasonal closures help overcome these limitations. Material exposed by road construction is erodible and difficult to revegetate. Special practices may be necessary to reestablish vegetation.

RANGE The unit is poorly suited to range management. Mountain meadows occupy 20 percent of the unit but produce over 80 percent of the available forage. Location of forage in widely scattered areas limits accessibility. Annual production of these meadows is about 2,225 pounds per acre of air dry herbage in normal years. Steep slopes and rock outcrop severely limit access by livestock. Snow cover limits the grazing season. Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand trampling by livestock. Loose hearding of sheep is particularly important for proper forage utilization in these alpine meadows. Timothy has invaded some meadows. This may alter grazing seasons and affect utilization.

WILDLIFE-FISHERIES The unit is potentially good summer and fall elk, bighorn sheep, moose and grizzly bear habitat. It also provides good fall and winter blue grouse habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	high
Sediment Delivery Efficiency	high
Timber Productivity	very low
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	40-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	low-high
Hydrologic Soil Groups	B, C

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 88-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of nearly level to gently sloping lava flow plateaus (block diagram). Delineations are mainly in the southern Madison Range, and south of Hebgen Lake.

M.U. COMPONENTS The unit contains moderately coarse textured soils. They have formed in material weathered from rhyolite and welded tuff. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes or contain glacial till deposits with forest or grassland vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Northern	7,200-7,800	5

The unit consists of large nearly level to gently sloping lava flow plateaus. The surface contains a pattern of parallel ridges separated by shallow troughs. Bedrock outcrops occur near ridgetops. These plateaus are dissected by well defined, intermittent streams. The drainage system has a dendritic pattern with low to moderate channel gradients. These landforms are stable. They have high subsurface water storage capacity and surface runoff is rare.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC), - 85 percent. Included HT with dissimilar management implications are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) and subalpine fir/pinegrass (ABLA/CARU) - 10 percent.

HABITAT DISTRIBUTION ABLA/VASC occurs throughout the unit. Lodgepole pine/grouse whortleberry (PICO/VASC) community types are included as similar HTs. Cool, dry climates and low timber productivity are associated with these HTs in this unit.

Included are up to 10 percent dissimilar HTs. ABLA-PIAL/VASC occurs at higher elevations and ABLA/CARU is on southern exposures. Both are less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forests. The forest understory is a dense mat of grouse whortleberry. On southern exposures pinegrass can occur in the understory.

GEOLOGY

OCCURRENCE The unit is underlain by rhyolite and welded tuff - 80 percent; other volcanic rocks - 15 percent; hard crystalline rocks - 5 percent.

The bedrock consists of light colored volcanic rocks (rhyolite) rock-like volcanic ash (welded tuff) and obsidian. They are Pliocene to Pleistocene in age. Dark colored volcanic rocks are included as similar. A thin layer of silty loess mantles the surface.

Included bedrocks with dissimilar properties are hard, coarse textured, crystalline rocks. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively drained, with moderately coarse to medium textures. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit consists of slightly acid soils with light colored surface layers. They occupy 75 percent of the unit. Included similar soils have subsoil clay accumulations.

Small areas of dissimilar soils are included. Moderately acid soils occur at higher elevations near Hebgen Lake in areas underlain by hard crystalline rock. They occupy 10 percent of the unit. Also, included are shallow soils near rock outcrops. They occupy 10 percent of the unit. Both soils are less productive timber sites.

GENERAL DESCRIPTION The soil surface is covered with a mat of partially decomposed forest litter 1 to 2 inches thick. The surface layer is brown gravelly loam or sandy loam about 3 inches thick. The subsoil is very pale brown, very gravelly sandy loam or loam about 20 inches thick. The substratum, a very pale brown, very gravelly sandy loam, overlies bedrock at a depths greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The major soils are Typic Cryochrepts, loamy skeletal, mixed. Included similar soils are Mollic Cryoboralfs, loamy skeletal, mixed; Typic Cryoboralfs, loamy skeletal, mixed; and Glossic Cryoboralfs, loamy skeletal, mixed.

The included dissimilar moderately acid soils are Dystric Cryochrepts, loamy skeletal, mixed. The shallow soils are Lithic Cryochrepts, sandy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 33-53 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is moderately limited by moisture stress and competition from pine grass on southern exposures. Designing cutting units to prolong snow melt and leaving logging slash for shade can help overcome the moisture stress limitation. Reduction of pinegrass improves regeneration on southern exposures.

ROADS The unit is well suited to road construction. No special location, design or maintenance practices are required. Revegetation of cut and fill slopes is slow.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. It is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit has little potential for wildlife habitat. Lack of water limits use by wildlife. Elk, mule deer, and grizzly bear make incidental use of the unit. It often borders major streams that contain trout habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	30-45
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 88-2A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of large, nearly level to rolling lava flow plateaus (block diagram). Delineations are near Hebgen Lake.

M.U. COMPONENTS This unit contains a complex of soils. Soils are moderately coarse to moderately fine textured. They have formed in material weathered from rhyolite and welded tuff. Native vegetation is dense lower subalpine forest.

ADJOINING M.U. Adjacent units have steep slopes or are glacial till deposits with subalpine forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
0-20	Variable	6,800-7,500	0

The unit consists of nearly level benches and rolling hills. These surfaces are dissected by well defined intermittent streams. The drainage system has a dendritic pattern with low to moderate channel gradients. These landforms have high subsurface water storage capacity and surface runoff occurs rarely.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/grouse whortleberry (ABLA/VASC) - 90 percent. An included HT with dissimilar management implications is subalpine fir/pinegrass (ABLA/CARU) -10 percent.

HABITAT TYPE DISTRIBUTION ABLA/VASC occurs throughout the unit. Cool, dry climates and low to moderate timber productivity are associated with this HT.

Included is up to 10 percent of the dissimilar HT, ABLA/CARU, on southern exposures. It is on more productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine forest. The forest understory is a thick mat of grouse whorleberry with some pinegrass.

GEOLOGY

OCCURRENCE The unit is underlain by rhyolite and welded tuff - 80 percent; other volcanic rocks - 15 percent; hard crystalline rocks - 5 percent.

The bedrock consists of light colored volcanic rocks (rhyolite) rock-like volcanic ash (welded tuff) and obsidian. They are Pliocene to Pleistocene in age. Dark colored volcanic rocks are included as similar. A thin layer of silty loess mantles the surface.

Included bedrocks with dissimilar properties are hard, coarse textured, crystalline rocks. Material weathered from these rocks is more erodible.

SOILS

GENERAL NATURE OF SOILS Soils are somewhat excessively to well drained, and slightly acid with moderately coarse to moderately fine textures. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soils are not obviously associated with landscape features. Soils with medium and moderately fine textures occur throughout. Included similar soils have darker colored surface layers. These soils occupy 65 percent of the unit. Soils with moderately coarse textures are on the highest ridgetops. They occupy 25 percent of the unit.

Included are up to 10 percent dissimilar soils. Moderately coarse textured soils with moderately acid subsoils are in areas underlain by hard crystalline rock. They are less productive timber sites.

GENERAL DESCRIPTION The medium and moderately fine textured soils have very pale brown, gravelly loam surface layers about 9 inches thick. Subsoils are very gravelly loam or clay loam about 20 inches thick. The substratum, a very pale brown, extremely stony loam, overlies bedrock at depths greater than 5 feet. See soil description 4 for more detail.

The moderately coarse textured soils have a brown sandy loam or loam surface layer about 7 inches thick. The subsoils are very pale brown, very gravelly sandy loam about 13 inches thick. The substratum, a very pale brown, very gravelly sandy loam overlies bedrock at depths greater than 5 feet. See soil description 21 for more detail.

CLASSIFICATION REMARKS The soils with medium and moderately fine textures are Typic Cryoboralfs, loamy skeletal, mixed. Similar included soils are Mollic Cryoboralfs, loamy skeletal, mixed and Glossic Cryoboralfs, loamy skeletal, mixed. The moderately coarse textured soils are Typic Cryochrepts, loamy skeletal, mixed.

The included dissimilar moderately acid soils are Dystric Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is well suited to timber management. The potential annual production is 33-35 cu. ft./acre. The unit is generally well suited to tractor operation. Regeneration is severely limited by summer moisture stress and competition from pinegrass. Design of cutting units to prolong snow melt and leaving logging slash for shade can help overcome the moisture stress limitation. Reduction of competing pinegrass can also help.

ROADS The unit is well suited to road construction. The material exposed by construction is slippery when wet on road surfaces. Surfacing or seasonal closures overcome this limitation.

RANGE The unit is poorly suited to range management. The forest understory produces little forage. It is poorly suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES This unit is potentially fair summer and fall elk habitat. The unit does not normally contain trout habitat but borders streams that do.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low to moderate
Forest Regeneration Limitations	severe
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	30-50
Precipitation Distribution	60% snow; 40% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	B

GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 91-2B

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping to moderately steep colluvial deposits (lower one-half of the block diagram). Delineations are mainly in the Bridger Range, the northern Absaroka-Beartooth Range, and the southeast Madison Range.

M.U. COMPONENTS This unit contains a complex of soils. Soils are medium textured with light and dark surface layers. They are formed in weathered talus deposits from sandstone and shale. Native vegetation is dense subalpine forest and mountain meadow.

ADJOINING M.U. Adjacent units have steep slopes or glacial till deposits with subalpine forest and meadow vegetation.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
10-45	Variable	7,800-8,500	5

The unit consists of gently sloping to moderately steep cone shaped colluvial deposits. They often occur at the base of steep slopes. Avalanche chutes are common, and bedrock outcrops are rare. These slopes are dissected by poorly defined intermittent streams. The drainage system has a parallel pattern with steep channel gradients. These landforms have a moderate landslide hazard. They have high subsurface water storage capacity but snowpacks are deep, and surface runoff occurs during snowmelt.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of subalpine fir/blue huckleberry (ABLA/VAGL) - 55 percent and Idaho fescue/bearded wheatgrass (FEID/AGCA) - 20 percent. Included HTs with dissimilar management implications are subalpine fir-whitebark pine/grouse whortleberry (ABLA-PIAL/VASC) - 20 percent.

HABITAT TYPE DISTRIBUTION ABLA/VAGL occurs throughout the unit in forested areas. Subalpine fir/grouse whortleberry (ABLA/VASC) and subalpine fir/heartleaf arnica (ABLA/ARCO) are included as similar HTs. Cool, moist climates and low timber productivity are associated with these HTs in this unit. FEID/AGCA occurs in moist mountain meadows. Highly productive range sites are associated with this HT.

Included are up to 20 percent dissimilar HTs. ABLA-PIAL/VASC is at higher elevations, and is on less productive timber sites.

EXISTING VEGETATION consists of dense lodgepole pine or whitebark pine forest. Large mountain meadows are scattered throughout the forest in most delineations. The forest understory is a dense mat of low shrubs, principally grouse whortleberry and blue huckleberry. The mountain meadows contain Idaho fescue, bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium and abundant forbs.

GEOLOGY

OCCURRENCE The unit contains colluvial deposits - 100 percent.

These deposits are derived primarily from sandstone, shale, and occasionally limestone. They are Pleistocene to Holocene in age. Typically this material is medium textured and contains numerous boulders, cobbles, and pebbles.

Included are some moderately coarse textured, more erodible, deposits near sandstone scarp slopes.

SOILS

GENERAL NATURE OF SOILS Soils are well drained, with medium textures. Subsoils contain more than 35 percent angular rock fragments.

OCCURRENCE AND DISTRIBUTION The unit contains a complex of soils. Soil properties vary with vegetation. Soils formed under forest have somewhat darkened surface layers. Included similar soils have lighter colored surface layers. These soils occupy 60 percent of the unit. Soils formed in meadows have thick dark colored surface layers. They occupy 20 percent of the unit.

Included are up to 15 percent dissimilar soils. Coarser textured soils are on steep, upper slopes and below rock outcrop. They are less productive.

GENERAL DESCRIPTION The soils with somewhat darkened surface layers have pale brown, gravelly loam surface layers about 9 inches thick. Subsoils are pale brown, very gravelly clay loam about 29 inches thick. The substratum, a very pale brown, very gravelly loam or clay loam, overlies bedrock at depths greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 7 for more detail.

The soils with thick dark colored surface layers have grayish brown, silt loam surface layers about 7 inches thick. Subsoils are pale brown, very gravelly clay loam about 12 inches thick. The substratum, a light yellowish brown, very gravelly clay loam, overlies bedrock at depths greater than 5 feet. Soil colors are variable because of variable parent material colors. See soil description 17 for more detail.

CLASSIFICATION REMARKS The soils with somewhat darkened surface layers are Mollic Cryoboralfs, loamy skeletal, mixed. Included as similar are Typic Cryoboralfs, loamy skeletal, mixed. The soils with thick dark colored surface layers are Argic Cryoborolls, loamy skeletal, mixed.

The included dissimilar soils are Typic Cryochrepts, loamy skeletal, mixed.

MANAGEMENT IMPLICATIONS

TIMBER The unit is moderately suited to timber management. The potential annual production is 32 to 69 cu. ft./acre. Slope steepness limits equipment operation on the steepest slopes. Cable yarding systems can overcome this limitation. Under certain moisture conditions equipment operation can compact or rut the soil. Operating equipment only when the soil is dry or covered with snow helps overcome this limitation. At the highest elevations, the harsh subalpine climate moderately limits regeneration.

ROADS The unit is well suited to road construction. Groundwater may be encountered during excavation. Drainage structures should be provided to redistribute intercepted groundwater. Material exposed by road construction tends to slough on steep cutbanks. Locating and designing roads to avoid wet soils and cutbanks over 5 feet high helps avoid cutbank and fill sloughing. Unsurfaced roads become rutted when wet. Surfacing or seasonal closures help overcome this limitation.

RANGE The unit is moderately suited to range management. Mountain meadows occupy 20 percent of the unit but produce 80 percent of the useable forage. The occurrence of forage in widely scattered meadows limits accessibility. The mountain meadow plant communities produce about 2,225 pounds of air dry herbage in normal years. Snow cover moderately limits the grazing season. Timothy has invaded some grasslands. This may alter grazing seasons and affect The forest understory produces little forage. The forested areas are moderately suited for use as transitory range following timber harvest.

WILDLIFE-FISHERIES The unit is potentially fair summer and fall mule deer, elk and bighorn sheep habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

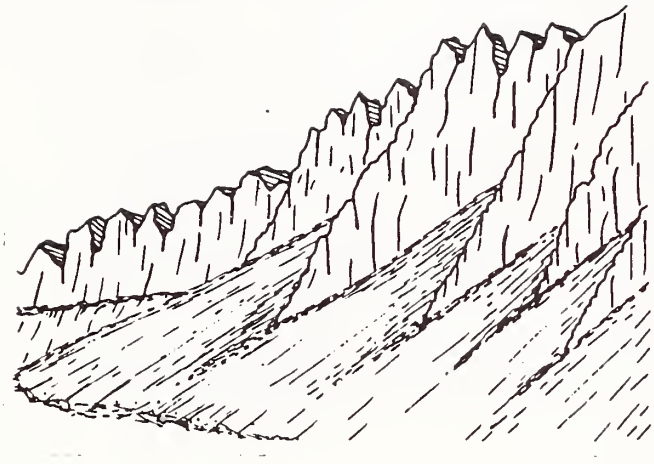
INTERPRETATIONS

Landslide Hazards	moderate
Soil Erodibility	moderate
Sediment Delivery Efficiency	low
Timber Productivity	low
Forest Regeneration Limitations	low-moderate
Forest Understory Forage Productivity	low
Grassland and Shrubland Productivity	high

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	35-60
Precipitation Distribution	80% snow; 20% rain
Average Winter Snow Depth (inches)	60+
Spring Runoff	May-June
Length of Frost Free Season (days)	less than 50
Potential Evapotranspiration	moderate.
Hydrologic Soil Groups	B



GALLATIN FOREST AREA
SOIL SURVEY

Draft

MAP UNIT DESCRIPTION

M.U. 93-1A

MAP UNIT SUMMARY

M.U. SETTING The landform consists of gently sloping to moderately steep talus slopes (lower one-half of the block diagram). Delineations occur throughout the survey area at higher elevations.

M.U. COMPONENTS The unit contains barren rubble land with small areas of soil included. The included soils support sparse upper subalpine forest or alpine meadows.

ADJOINING M.U. Adjacent units have very steep rocky slopes, gently sloping glacial till deposits, or gently sloping cirque basins with sparse subalpine forest.

TOPOGRAPHY

SLOPE (%)	ASPECT	ELEVATION (FT.)	ROCK OUTCROP (%)
20-45	Variable	7,000-9,800	40-90

The unit consists of gently sloping to moderately steep, talus slopes, rock glaciers and avelanche chutes. Local relief is characterized by rough and broken boulder fields. Bedrock outcrops are common, especially on upper slopes. These landforms are not dissected by streams. They have high subsurface water storage capacity and surface runoff is rare.

VEGETATION

HABITAT TYPE (HT) OCCURRENCE The unit consists of barren talus slopes - 40-90 percent; whitebark pine-subalpine fir (PIAL-ABLA) HT or Idaho fescue/tufted hairgrass (FEID/DECA) - 10-60 percent.

HABITAT TYPE DISTRIBUTION PIAL-ABLA occurs in forested areas and FEID/DECA occurs in alpine meadows. Cold, alpine climates and very low timber and range productivity are associated with these HTs in this unit.

EXISTING VEGETATION consists of islands of stunted whitebark pine forest or alpine meadow within rubble land.

GEOLOGY

OCCURRENCE The unit contains talus slopes - 100 percent.

The talus deposits are derived primarily from hard crystalline rocks and occasionally sandstone or limestone. They are Pleistocene to Holocene in age. Typically these deposits are composed of angular stones, boulders, and cobbles.

SOILS

GENERAL NATURE OF SOILS The unit is dominantly rubble land. Less than 10 percent of the unit is occupied by soil.

MANAGEMENT IMPLICATIONS

TIMBER The unit is unsuited to timber management.

ROADS The unit is poorly suited to road construction. The material exposed by road construction tends to unravel on cutbanks and is too rocky for use as road surface. Surfacing can overcome this limitation. Avalanches can make winter use hazardous and leave debris on road surfaces.

RANGE The unit is unsuited for range management.

WILDLIFE-FISHERIES This unit is potentially good mountain goat and bighorn sheep habitat. The unit does not normally contain trout habitat nor does it border streams containing habitat.

INTERPRETATIONS

Landslide Hazards	low
Soil Erodibility	---
Sediment Delivery Efficiency	low
Timber Productivity	---
Forest Regeneration Limitations	---
Forest Understory Forage Productivity	---
Grassland and Shrubland Productivity	---

See Use and Management Section for more detail.

CLIMATIC FEATURES

Mean Annual Precipitation (inches)	25-60
Precipitation Distribution	variable
Average Winter Snow Depth (inches)	26-60+
Spring Runoff	April-June
Length of Frost Free Season (days)	less than 50-90
Potential Evapotranspiration	moderate
Hydrologic Soil Groups	A

Section 4. Use and Management (Interpretations of Map Units)

HOW TO USE THESE TABLES

One of the most important purposes of the survey is to provide interpretive information for users. The following tables can be used to interpret Map Units for uses in engineering, watershed management, timber management, range management, wildlife, and wildfire management. Each set of tables has an introduction which describes some potential uses of the table, what the column headings mean, and generally how the interpretations were developed.

The interpretations are designed for planning for projects on a general scale. They should not be used for site specific applications, unless the site is investigated "on the ground" to make sure the soils and site characteristics are the same as in the Map Unit Description. This is because there are small areas of "inclusions" in Map Units. These small areas have soils and site characteristics that are different from the majority of the Unit. They occur because at this scale of soil survey, these areas are too small to map or can not be identified.

ENGINEERING

Road construction is the primary engineering use of soils in forest management. About 3-4 miles of road are required to place a section of timber under management. Several standards of roads are constructed in the survey area. Arterial or collector roads are normally either 12 feet wide with ditch or 14 feet wide without ditch. Local logging roads are normally drained by rolling grades, or water bars and occasionally outsloping. They are often closed when not needed for hauling logs. Normally, no surfacing is used.

Data presented in this section can be used for chosing between alternative road locations and designs. Land use planners can use this data to evaluate the feasibility of allocating land to uses requiring road access. Transportation planners can use this to evaluate alternative routes. Design engineers can use it to plan detailed onsite investigations of soil and geology. This information does not eliminate the need for on-site investigations, testing and analysis.

Table 1 MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION gives properties of map units which affect road location and construction. This information can be used by the transportation planner to evaluate alternative road locations.

Vegetative cover affects clearing costs. Representative habitat type can be used to select appropriate seed mixtures for cut and fill slopes. Habitat types are integrators of environmental factors affecting plant growth. The environment on road cuts and fills differs appreciably from the undisturbed conditions indicated by habitat types but the implied climate and soil relationships can help select species adapted to local conditions.

Frequency of wet areas affects difficulty of road location. Wet areas are avoided when possible because of stability hazards and road drainage problems associated with them. A "low" rating indicates that wet areas occur infrequently and are easily avoided. A "medium" rating indicates that wet areas occur commonly but can normally be avoided by varying grade and alignment. A "high" rating indicates that wet areas are difficult to avoid entirely.

Depth to bedrock and bedrock hardness can be used to assess difficulty of excavation. The depth to bedrock can be used to estimate the probability of encountering bedrock during excavation. Depths to bedrock were estimated based on field observations. Very hard bedrock is usually non-rippable unless highly fractured. Hard bedrock may be rippable in places but appreciable non-rippable rock occurs. Soft and very soft bedrock are most often rippable.

Stream channels per mile is the average number of surface drainage channels which must be crossed by roads located across the map unit. It can be used to estimate the number of culverts needed.

Slope complexity is a rating of the frequency of slope and aspect changes. As slope complexity increases, more excavation and filling are required to maintain grade and alignment. "Low" complexity indicates slopes are long and smooth with changes more than several thousand feet apart. "Moderate" complexity indicate slope or aspect changes occur between 800 and several thousand feet apart. "High" complexity indicates slope or aspect changes occur less than 800 feet apart.

Avalanche hazard is a rating of the probability of avalanches occuring in a map unit. Avalanches occur most commonly on slopes steeper than 60 percent with moderate to deep snowpack (La Chapelle, 1970). Non-forested slopes and avalanche chutes are more likely to have avalanches than forested slopes. "High" ratings indicate large avalanches are probable every winter. "Moderate" ratings indicate small avalanches are probable every several years. "Low" ratings indicate avalanches are rare. Avalanches deposit debris on roads and are a hazard to winter use of roads.

Table 2 BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS gives estimates of the engineering properties and classifications for the soil substrata within each map unit in the survey area. The ratings generally apply to the material below a depth of 3 feet. Road construction on steep slopes mixes the surface 2 to 3 feet of soil with many feet of substratum material. The properties of the high material used for road fills and native road surfaces are normally determined by characteristics of the soil substratum. The performance of the high cutbanks produced by road construction on steep slopes is also determined by the substrate material. The estimates are based on tests of materials sampled in the survey area and relationships between the properties of materials and their geologic origins.

USDA textural group is a generalized description of the soils in the map unit. The terms are defined in terms of the percentages of sand, silt, and clay in the soil.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. The estimates are based on 77 samples taken within the survey area on many different types of soil.

Average rock fragment content is an estimate by volume for depths below about 3 feet. These fragments are greater than 2 mm in size. Most are greater than 3 inches.

Average liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil. They are used in the unified classification and as indicators in making general predictions of soil behavior. The estimates are based on test data from the survey area and field observations.

Table 3 SUITABILITIES AND LIMITATIONS FOR CUT AND FILL CONSTRUCTION, MAINTENANCE, AND SITE RECLAMATION rates the limitations to excavation and road maintenance, suitabilties for use as native road surfaces, revegetation of soil exposed by construction, and as sources of topsoil and aggregate.

Excavation is required for cut and fill road construction. The cost of excavation is affected by slope steepness, depth to non-rippable bedrock and frequency of wet areas. Map units with "slight" limitation have slopes less than 30 percent, no wet areas and little or no non-rippable bedrock within the layer excavated. Map units with "moderate" limitation may have common wet areas or non-rippable bedrock within the layer excavated. Slope steepness is variable. Map units with "severe" limitations have frequent non-rippable bedrock within the area excavated and slopes commonly greater than 45 percent.

Cut and fill maintenance cost is affected by the tendency of cutslopes to fail due to landslides or sloughing often associated with seepage, by the tendency of incoherent soil and rock exposed on steep cutslopes to ravel and block the drainage system, big sheet and rill erosion of unvegetated cutslopes, by flooding which may erode fills or damage stream channel crossings and by avalanches which may deposit debris on the road.

Roads constructed on map units with "slight" limitations normally require only routine blading of the surface. Roads constructed on map units with "moderate" limitations occasionally require special maintenance. Special maintenance may include removing material blocking the drainage system or road surface as a result of cutbank erosion, raveling, sloughing or avalanches; or replacing culverts and fills damaged by floods. Roads constructed on map units with "severe" limitations require this special maintenance frequently.

Native road surface is a rating of suitability of the material exposed by road construction for use as road surface. Suitability is limited by material which ruts or becomes slippery when wet or which contains many rock fragments larger than 3 inches in diameter. When a map unit contains soils with different suitability, the least suitable soil is rated. Map units rated "good" contain coarse grained soils with few cobbles and boulders. Map units rated "fair" either contain soils with many cobbles and boulders or soils formed in very gravelly nonplastic or slightly plastic silts which are slippery when wet. Map units rated "poor" contain loamy or clayey soils with little gravel. They rut when wet.

Revegetation of disturbed sites is a rating of the suitability of the material exposed by road construction or similar construction activities for establishment of erosion control seedings. These seedings are normally mixtures of climatically adapted domestic grasses and legumes. The seed is broadcast as soon as possible after construction. Mulch and fertilizer may be applied with the seed. Suitability is affected by soil fertility, water holding capacity and climatic limitations.

Units rated "good" contain loamy or clayey material containing less than 60 percent rock fragments and are within the temperate forest zone. Units rated "fair" contain loamy or clayey material containing less than 60 percent rock fragments and are in the shortgrass prairie or mountain grasslands Xeric forest zone. Units rated "poor" may contain sandy material containing more than 60 percent rock fragments or are in the alpine zone. Units rated "fair" or "poor" generally require special practices to establish seedings such as hand planting shrubs or topsoiling or may have to be planted several times before successful establishment.

Topsoil is used in areas where vegetation is to be established but the exposed material is a poor plant growth medium. Mine spoils, gravel pits, and borrow areas commonly require topsoil for establishment of vegetative cover.

Topsoil suitability is affected by the ease of cooking and spreading soil in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken. Ease of excavating is influenced by slope steepness, shallow bedrock wetness, rock fragment content, and thickness of the suitable material. Suitability for plant growth is influenced by texture and organic matter content.

Soils rated "good" have more than 16 inches of loamy or dark colored topsoil and contain few rock fragments. Shallow bedrock, slope steepness, and water tables do not limit excavation. Soils rated "fair" have dark colored loamy topsoils less than 16 inches thick which may contain rock fragments. Shallow bedrock, slope steepness, and water tables do not limit excavation. Soils rated "poor" have light colored or sandy topsoils which may contain many rock fragments. Excavation may be limited by slope steepness, shallow bedrock or water tables.

Aggregate is used for road surfacing and base course. Sources may be unconsolidated deposits of gravel or bedrock suitable for quarrying. Some material may be used pit run, but others must be crushed. Suitability is affected by accessibility of the material. Soils with fine excessive fines and soft bedrocks are not considered suitable material. Units rated "good" contain deposits of suitable material at least 3 feet thick within 6 feet of the surface. Units rated "fair" contain deposits of suitable material less than 3 feet within 6 feet of the surface. Units rated "poor" do not contain deposits of suitable material within 6 feet of the surface.

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
12-1A	90	5	5	ABLA-PIAL/VASC	none	4-6	very hard	1-7	low	low
12-1C	95	0	5	ABLA/VASC	none	4-6	very hard	1-7	low	low
12-2A	95	0	5	ABLA/VASC	none	4-6	very hard	1-7	low	low
12-2B	90	5	5	ABLA-PIAL/VASC	none	4-6	hard to soft	1-7	low	low
13-1A	0	80	20	FEID/DECA	none	2-4	very hard	1-2	low	low
13-2A	0	95	5	FEID/DECA	none	2-4	hard to soft	1-2	low	low
22-1A	80	0	20	ABLA/VASC ABLA-PIAL/VASC	low	2-10	very hard	10-20	high	medium
22-1B	50	20	30	PSME/FEID FEID/AGSP ABLA/CARU	low	2-10	very hard	10-20	low	medium
22-1C	10-50	0-50	50-90	PIAL-ABLA FEID/DECA	low	2-10	hard to soft	10-20	high	medium
22-2A	65	15	20	ABLA/VASC FEID/AGCA	low	2-10	hard to soft	10-20	high	medium
22-3A	65	10	25	ABLA/VASC PSME/SYAL	low	2-10	hard	10-20	high	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
22-3C	65-85	5-20	10-30	ABLA/VASC ABLA-PIAL/VASC	high	2-10	very hard	10-20	low	high
25-1A	10-20	45-70	10-30	FEID/DECA PIAL-ABLA	low	2-10	very hard	2-5	low	low
25-3A	30	45	25	FEID/DECA PIAL-ABLA	low	2-10	hard to soft	2-5	low	low
34-1A	90	0	10	ABLA-PIAL/VASC	low	6-40	variable	2-10	low	high
34-1B	20	75	5	ARTR/FEID PSME/FEID	none	6-40	variable	2-10	low	medium
34-1C	90	0	10	ABLA/VASC	low	6-40	variable	2-10	low	medium
34-1D	90	5	5	PSME/SYAL PSME/FEID	none	6-40	variable	2-10	low	medium
34-2C	60	35	5	ABLA-PIAL/VASC FEID/AGCA	medium	6-40	variable	2-10	moderate	medium
34-2D	60	35	5	ABLA/VASC FEID/AGCA	low	6-40	variable	2-10	low	medium
34-3A	85	5	10	ABLA-PIAL/VASC	medium	6-40	variable	2-10	low	high
34-3B	90	0	10	ABLA/VASC	medium	6-40	variable	2-10	low	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
34-4B	90	10	0	ABLA/VASC	low	6-40	variable	2-10	low	medium
34-4C	25	75	0	ARTR/FEID PSME/SYAL	none	6-40	variable	2-10	low	medium
35-1A	85	0	15	ABLA-PIAL/VASC	low	6-40	variable	2-10	high	medium
35-1B	5	90	5	ARAR/FEID	none	6-40	variable	2-10	low	medium
35-1C	90	0	10	ABLA/VASC	low	6-40	variable	2-10	low	medium
35-2C	70	20	5	ABLA/VASC FEID/AGCA	low	6-40	variable	2-10	low	medium
35-3A	70	15	15	ABLA-PIAL/VASC FEID/AGCA	low	6-40	variable	2-10	moderate	high
35-3B	90	0	10	ABLA/VASC	medium	6-40	variable	2-10	low	medium
35-4C	20	70	10	ARTR/FEID PSME/SYAL	none	6-40	variable	2-10	low	medium
46-1B	0	100	0	ARTR/AGSP FEID/AGSP	low	20-40	variable	1-5	low	low
46-2A	20	80	0	FEID/AGSP ARTR/FEID PSME/SYAL	low	20-40	variable	1-5	low	low

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
46-3A	100	0	0	PICO/PUTR	none	30-50	variable	1-5	low	low
53-1A	20	65	15	FEID/AGSP ARTR/FEID PSME/SYAL	none	10-30	very hard	5-10	low	high
53-1D	95	0	5	ABLA/LIBO ABLA/ALSI	medium	10-30	very hard	5-10	low	high
53-3A	5	85	10	ARTR/FEID FEID/AGSP	none	15-35	hard to soft	5-10	low	high
53-3B	95	0	5	ABLA/VASC PSME/SYAL	low	15-35	hard to soft	5-10	low	high
53-3C	95	0	5	ABLA/LIBO	low	15-35	hard to soft	5-10	low	high
54-1A	35	45	20	FEID/AGSP ARTR/FEID	none	2-10	very hard	8-15	low	medium
54-1B	60	0	40	PSME/FEID ABLA/VASC (variable)	none	2-10	very hard	8-15	moderate	medium
54-1C	85	0	15	PSME/SYAL	none	2-10	very hard	8-15	low	medium
54-1E	65	5	30	ABLA-PIAL/VASC	none	2-10	very hard	8-15	high	medium
54-1G	85	0	15	ABLA/VASC PSME/SYAL	none	2-10	very hard	8-15	low	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
54-2B	30	30	40	PSME/SYAL FEID/AGSP	none	2-10	hard	8-15	low	medium
54-2C	60	0	40	ABLA/VAGL ABLA/LIBO (variable)	none	2-10	hard	8-15	moderate	medium
54-2D	35	50	15	PSME/SYAL FEID/AGSP	none	2-10	hard to soft	8-15	low	medium
54-2E	80	5	15	ABLA/VASC ABLA/CARU	none	2-10	hard to soft	8-15	moderate	medium
54-3A	5	80	15	FEID/AGSP ARTR/FEID	none	2-10	hard to soft	8-15	low	medium
54-3C	65	20	15	PSME/SYAL FEID/AGSP	none	2-10	hard to soft	8-15	low	medium
54-3D	75	5	10	ABLA/LIBO PSME/VAGL	medium	2-10	hard to soft	8-15	low	medium
54-3E	90	0	10	ABLA-PIAL/VASC ABLA/VASC	none	2-10	hard to soft	8-15	moderate	medium
54-3F	90	10	40	ABLA/CARU	none	2-10	hard to soft	8-15	low	medium
54-5A	65	15	20	PSME/PHMA PSME/FEID	none	2-10	soft	8-15	low	medium
54-5C	75	0	25	PSME/PHMA PSME/FEID	none	2-10	soft	8-15	low	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
61-2A	40	60	0	FEID/AGSP ARTR/FEID PSME/FEID	low	25-40	variable	1-5	low	low
64-2A	40	60	0	FEID/AGSP ARTR/FEID PSME/FEID	low	25-40	variable	1-5	moderate	low
64-2C	90	10	0	ABLA/VAGL PICEA/GATR	medium	25-40	variable	1-5	high	low
66-1A	5	95	0	DECA/CAREX	high	25-40	variable	1-5	variable	low
71-1A	85	15	0	ABLA/GATR ABLA/VAGL	high	25-40	variable	5-10	low	high
71-1B	35	65	0	FEID/AGSP ARTR/FEID ABLA/VAGL	low	25-40	variable	5-10	low	high
71-1C	85	15	0	ABLA-PIAL/VASC	high	25-40	variable	5-10	low	high
71-1D	90	10	0	ABLA/VASC	low	25-40	variable	5-10	low	high
71-1E	15	85	0	PSME/SYAL ABLA/VAGL	medium	25-40	variable	5-10	low	high
71-2A	95	5	0	ABLA/LIBO	high	25-40	soft	5-10	low	high
71-2B	85	15	0	ABLA/VASC	low	25-40	variable	5-10	low	high

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
71-2C	85	15	0	ABLA-PIAL/VASC ABLA/VASC FEID/AGCA	medium	25-40	variable	5-10	low	high
71-2D	40	60	0	ARTR/FEID PSME/SYAL	low	25-40	variable	5-10	low	high
82-2B	90	5	5	ABLA/VASC ABLA/LIBO	low	5-10	hard to soft	2-5	low	low
82-2C	85	10	5	ABLA-PIAL/VASC	medium	5-10	hard to soft	2-5	low	low
84-1A	80	15	5	PSME/PHMA ABLA/VASC FEID/AGCA	medium	5-10	hard to soft	5-10	low-moderate	low
84-1B	15	80	5	FEID/AGSP ARTR/FEID	low	5-10	hard to soft	5-10	low	medium
84-2B	75	20	5	ABLA/VAGL FEID/AGSP	low	4-10	soft	5-10	low	medium
85-2A	75	0	25	PSME/FEID PSME/SYAL	low	2-10	hard	5-10	low	medium
85-2B	75	10	15	ABLA/VAGL PSME/SYAL	none	2-10	hard	5-10	moderate	medium
85-3A	50	30	20	PSME/SYAL FEID/AGSP ARTR/FEID	low	5-15	soft	5-10	low	medium
85-3B	80	10	10	ABLA/VAGL PSME/SYAL	low	5-15	soft	5-10	moderate	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
86-2A	65	30	5	ABLA/VAGL FEID/AGCA	none	2-10	hard to soft	5-10	low	low
86-2C	10	85	5	FEID/AGSP ARTR/FEID	none	5-15	hard to soft	5-10	low	low
86-2D	85	10	5	ABLA/VASC ABLA-PIAL/VASC	high	5-15	hard to soft	1-10	low	low
86-2E	45	50	5	ABLA-PIAL/VASC FEID/AGCA	medium	5-15	hard to soft	1-10	low	low
86-3B	80	15	5	ABLA/VASC PSME/SYAL	none	5-15	soft	1-5	low	low
86-3C	10	85	5	FEID/AGSP ARTR/FEID	none	5-15	soft	1-5	low	low
87-1A	20-40	10-20	40-60	PIAL-ABLA FEID/DECA	none	2-10	hard	5-10	high	low
87-1B	10	75	15	FEID/AGSP ARTR/FEID	none	2-10	hard	5-10	moderate	low
87-1D	75	5	20	ABLA/VASC	low	2-10	hard	5-10	moderate	low
87-2A	65	25	10	PSME/FEID FEID/AGSP	low	2-10	hard to soft	5-10	moderate	medium
87-2B	75	10	15	PSME/SYAL ABLA/VASC	none	2-10	hard to soft	5-10	high	medium

TABLE 1: MAP UNIT FEATURES AFFECTING ROAD LOCATION AND CONSTRUCTION

Map Unit Symbol	Vegetation Cover 2/ Forest (%)	Non-Forest (%)	Rock Outcrop (%)	Representative Habitat Types	Frequency of Wet Areas	Depth to Bedrock (feet)	Bedrock Hardness	Stream Channels per Mile	Avalanche Hazard	Slope Complexity
87-2C	30	60	10	FEID/AGSP ARTR/FEID	none	2-10	hard to soft	5-10	low	medium
87-2D	90	0	10	ABLA/VAGL	medium	2-10	hard to soft	5-10	high	medium
87-2E	60	20	20	ABLA-PIAL/VASC FEID/DECA	low	2-10	hard to soft	5-10	high	medium
88-1A	95	0	5	ABLA/VASC	none	5-10	hard to soft	1-5	low	low
88-2A	100	0	0	ABLA/VASC	none	5-10	hard to soft	1-5	low	low
91-2B	75	20	5	ABLA/VAGL FEID/DECA	low	5-40	hard to soft	0-2	moderate	low
93-1A	5-30	5-30	40-90	PIAL-ABLA FEID/DECA	none	5-40	very hard	0-2	high	low

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
12-1A	moderately coarse	GM	60	15	3
12-1C	moderately coarse medium	GM	60	15	3
12-2A	medium moderately fine	GM, CL	40	15-41	3-20
12-2B	medium moderately fine	GM, CL	40	15-41	3-20
13-1A	moderately coarse	GM, SM, GW	60	7-15	2-3
13-2A	moderately fine	GM, SC, CL	20-40	15-41	10-20
22-1A	coarse	GM, GW, SM	60	7-15	2-3
22-1B	moderately coarse	GM	60	15	3
22-1C	moderately coarse medium	GM, SM	60	7-15	2-3
22-2A	moderately coarse medium	GM, CL	20-60	15-41	3-20
22-3A	medium	GM, SM	60	7-15	2-3
22-3C	moderately coarse	GM, SM	60	7-15	2-3

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
25-1A	moderately coarse	GM	50	15	3
25-3A	medium moderately fine	GM, CL	40	15-41	3-20
34-1A	moderately coarse	GM	50	15	3
34-1B	moderately coarse medium	GM	50	15	3
34-1C	moderately coarse medium	GM	50	15	3
34-1D	moderately coarse medium	variable	variable	15	3
34-2C	medium	GM, CL	10-40	15-41	3-20
34-2D	medium moderately fine	GM, CL	40	15-41	3-20
34-3A	medium moderately fine	GM, CL	40	15-41	3-20
34-3B	medium moderately fine	GM, CL	40	15-41	3-20
34-4B	medium moderately fine	variable	30-40	—	—

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
34-4C	moderately fine	variable	20	—	—
35-1A	moderately coarse	GM	50	15	3
35-1B	moderately coarse medium	GM	50	15	3
35-1C	moderately coarse medium	GM	50	15	3
35-2C	moderately fine	ML, MH, CL	10-20	18-66	5-24
35-3A	medium moderately fine	GM, SM, CL	35	7-41	12-22
35-3B	medium moderately fine	GM, SM, CL	35	7-41	12-22
35-4C	moderately fine	variable	20	—	—
46-1B	moderately coarse medium	GW, GM, SM, SC, ML	60	7-33	2-10
46-2A	medium moderately fine	GM, CL	60	15-41	3-20
46-3A	coarse	SW, SM	35	7	2

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
53-1A	medium moderately fine	GM, SM	40	7-15	2-3
53-1D	moderately coarse medium	GM, SM	40	7-15	2-3
53-3A	moderately fine	GM	40	15	3
53-3B	medium moderately fine	GM, ML, CL	35	15-41	3-20
53-3C	medium moderately fine	GM, SM, CL	35	7-41	2-20
54-1A	moderately coarse	GM	60	15	3
54-1B	moderately coarse	GM	60	15	3
54-1C	moderately coarse	GM	60	15	3
54-1E	moderately coarse	GM	60	15	3
54-1G	moderately coarse medium	GM	60	15	3
54-2B	medium moderately fine	GM, ML	60	15-18	3-5
54-2C	moderately coarse medium	GM, ML	60	15-18	3-5

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
54-2D	medium moderately fine	GM, ML, CL	40	15-41	3-20
54-2E	medium moderately fine	GM, ML, CL	40	15-41	3-20
54-3A	moderately fine	GM, SM, SC, ML	40	7-33	2-10
54-3C	medium moderately fine	GM, SM	40	7-15	2-3
54-3D	medium moderately fine	GM, SM, SC, ML, CL	30	7-41	2-20
54-3E	moderately coarse medium	GM, SM, SC ML	40	7-33	2-10
54-3F	moderately coarse medium fine	GM, SM, SC, ML	40	7-33	2-10
54-5A	moderately coarse medium	GM, GC, SC, ML	40	15-35	3-14
54-5C	moderately coarse medium	GM, GC, SC, ML	40	15-35	3-14

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
61-2A	moderately coarse moderately fine	variable	60	—	—
64-2A	medium moderately fine	variable	60	—	—
64-2C	medium moderately fine	variable	60	—	—
66-1A	variable	variable	60	—	—
71-1A	moderately fine fine	SC, MH, CL	20	33-66	10-24
71-1B	moderately fine	GM, SM, SC, MH, CL	10-20	7-66	2-24
71-1C	moderately fine	GM, SM, SC, MH, CL	10-20	7-66	2-24
71-1D	moderately coarse moderately fine	GM, SM, SC, MH, CL	30	7-66	2-24
71-1E	moderately fine fine	GM, SM, SC,	10-30	—	—
71-2A	moderately fine fine	GM, SM, SC, CL, MH	10-30	7-41	2-20
71-2B	moderately fine	GM, SM, SC, CL	10-40	7-41	2-20
71-2C	moderately fine	GM, SM, SC, CL	30	7-41	2-20

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
71-2D	moderately fine	GM, SM, SC, CL	10-30	7-41	2-20
82-2B	moderately fine	GM, MH, CL	15-30	15-66	3-24
82-2C	moderately fine	GM, CL	30	15-41	3-20
84-1A	moderately fine	GM, MH, CL	20	15-66	3-24
84-1B	moderately	GM, MH, CL	30	15-66	3-24
84-2B	moderately fine	variable	35	—	—
85-2A	medium	GM, ML	35-50	15-18	3-5
85-2B	medium moderately fine	GM, CL, ML	35-50	15-18	3-5
85-3A	medium moderately fine	variable	35	—	—
85-3B	medium moderately fine	variable	35	—	—
86-2A	moderately fine	GM, ML	10-20	15-18	3-5
86-2C	moderately fine fine	GM, CL, ML, MH	10-20	15-66	3-24
86-2D	moderately fine	GM, CL, MH, ML	3-50	15-66	3-24

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
86-2E	medium moderately fine	GM, CL, MH, ML	10-30	15-66	3-24
86-3B	moderately fine	variable	10-30	—	—
86-3C	moderately coarse moderately fine	variable	10-40	—	—
87-1A	moderately coarse medium	GM, ML	60	15-18	3-5
87-1B	medium moderately fine	GM, ML	60	15-18	3-5
87-1D	medium moderately fine	GM, ML	60	15-18	3-5
87-2A	moderately fine	GM, CL, ML	3-20	15-41	3-20
87-2B	medium moderately fine	GM, CL, ML	15-50	15-41	3-20
87-2C	medium moderately fine	GM, CL, ML	10-50	15-41	3-20
87-2D	moderately fine	GM, CL, ML	35-50	15-41	3-20
87-2E	medium moderately fine	GM, CL, ML	10-40	15-41	3-20

TABLE 2: BASIC ENGINEERING PROPERTIES AND CLASSIFICATIONS

Map Unit Symbol	USDA Soil Textural Group	Unified Classification	Average Rock Fragment Content (Percent)	Average Liquid Limit	Average Plasticity Index
88-1A	moderately coarse medium	GM	60	15	3
88-2A	moderately coarse moderately fine	GM	60	15	3
91-2B	medium	GM, CL	40	15-41	3-20
93-1A	coarse	variable	80	—	—

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TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
Symbol	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
12-1A	slight		slight		good		fair	moisture stress short season	poor	droughty	good	
12-1C	slight		slight		good		fair	moisture stress low fertility	poor	droughty	good	
12-2A	slight		slight		poor	slick when wet	fair to good	moisture stress low fertility	poor	low fertility	poor	soft materi
12-2B	slight		slight		poor	slick when wet	fair to good	moisture stress short season	poor	low fertility	poor	soft materi excess fine
13-1A	moderate	non-rippable bedrock	slight		good		poor	short season	poor	droughty	good	
13-2A	slight		slight		fair	ruts	poor	short season	good		poor	soft materia excess fines
22-1A	severe	slope	severe	cutbanks unravel	good to fair	rocky surface	poor	shallow soils moisture stress	poor	steep slope	good	
		non-rippable bedrock		sparse cover								
22-1B	severe	heavy cuts and fills	severe	cutbanks unravel	good		poor	shallow soils		steep slope	good	
		non-rippable bedrock		sparse cover								

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TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
Symbol	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitation
22-1C	severe	slope	severe	cutbanks unravel	good to fair	rocky surface	poor	shallow soils moisture stress	poor	steep slope	good	
		non-rippable bedrock		sparse cover								
22-2A	severe	slope	severe	cutbank erosion	good to poor	ruts	poor to fair	shallow soils moisture stress	poor	steep slope	fair	soft mater
		wet areas		cutbanks slough								
22-3A	severe	heavy cuts and fills	severe	cutbank erosion	good		poor	shallow soils moisture stress	poor	steep slope	fair	soft mater
		frequent culverts		sparse cover								
22-3C	moderate	non-rippable bedrock	moderate	cutbanks unravel	fair	rocky surface	poor	shallow soils moisture stress	poor	droughty	good	
25-1A	slight		moderate	cutbanks unravel	good		fair to poor	moisture stress short season	poor	droughty	good	
				sparse cover								
25-3A	slight		slight	cutbank erosion	good to poor	ruts	fair to poor	short season moisture stress	good		fair	soft mater low volume
34-1A	slight		moderate	cutbanks unravel	good		fair to good	moisture stress short season	poor	droughty	good	

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
Symbol	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
34-1B	slight		moderate	cutbanks unravel	good		fair	moisture stress	fair	many rocks	good	
34-1C	slight		moderate	cutbanks unravel	good		good to fair	moisture stress low fertility	poor	droughty	good	
34-1D	slight		moderate	cutbanks unravel	good			moisture stress	fair to poor	droughty	good	
34-2C	slight		moderate	cutbank erosion	poor		fair to good	moisture stress short season	poor to fair	low fertility	poor	excess fines
				cutbanks slough								
34-2D	slight		moderate	cutbanks slough	poor	ruts	good		poor to fair	low fertility	poor	excess fines
34-3A	slight		moderate	cutbanks slough	fair	slick when wet	fair to good	moisture stress short season	fair	low fertility	poor	excess fines
34-3B	slight		moderate	cutbanks slough	poor	slick when wet	good		fair	droughty	poor	excess fines
34-4B	slight		slight		variable	ruts	good		fair	low fertility	poor	excess fines
34-4C	slight		slight		variable	ruts	fair	moisture stress	good		poor	excess fines
35-1A	moderate	non-rippable bedrock	severe	cutbanks unravel	good		poor	low fertility	poor	droughty	good	
				avalanche								

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
Symbol	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
35-1B	moderate	slope	severe	cutbanks unravel	good		poor	low fertility soil sloughing	fair	droughty	fair	low volume
35-1C	moderate	slope	severe	cutbanks unravel	good		poor to good	low fertility soil sloughing	poor	droughty	good	
35-2C	moderate	slope	moderate	cutbanks slough	fair to poor	ruts badly	good		fair	low fertility	poor	excess fines
35-3A	moderate	slope	moderate	cutbank erosion	fair	slick when wet	fair to good	moisture stress short season	fair	many rocks	poor	excess fines
35-3B	moderate	slope	slight		fair	slick when wet	fair to good	moisture stress low fertility	fair	many rocks	poor	excess fines
35-4C	moderate	slope	moderate	cutbanks slough	variable	ruts	fair	moisture stress	good		poor	excess fines
46-1B	slight		slight		good to fair	rocky surface	fair	moisture stress	variable		good	
46-2A	slight		slight		good to poor	ruts	fair	moisture stress	variable		fair	excess fines
46-3A	slight		slight		good		fair	moisture stress	poor	droughty	poor	soft materia
53-1A	slight		slight		good		fair	moisture stress	good		poor	soft materia low volume

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
53-1D	slight		slight		good		fair to good	moistures stress low fertility	poor	droughty	fair	low volume
53-3A	slight		slight		good to fair	slick when wet	fair	moisture stress	good		poor	excess fin
53-3B	slight		slight		good to fair	slick when wet	fair to good	moisture stress	good			excess fine
53-3C	slight		slight		good to fair	slick when wet	good		fair	low fertility	poor	excess fine
54-1A	severe	slope	moderate	cutbank erosion	good		poor to fair	moisture stress shallow soils	poor	shallow soils	fair	low volume
54-1B	severe	slope	severe	cutbank erosion	fair	rocky surface	poor to fair	moisture stress shallow soils	poor	droughty	good	
				sparse cover								
54-1C	moderate	non-rippable bedrock	moderate	cutbank erosion	good		fair	low fertility moisture stress	poor	droughty	moderate	excess fines
54-1E	severe	slope	severe	cutbank erosion	good		poor	shallow soils short season	poor	droughty	good	
		non-rippable bedrock		avalanche								
54-1G	moderate	non-rippable bedrock	moderate	cutbank slough	good		fair	moisture stress low fertility	poor	droughty	fair	excess fines

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
54-2B	severe	slope non-rippable bedrock	slight		poor	ruts	poor to fair	moisture stress shallow soils	poor	shallow soils	fair	low volume
54-2C	severe	slope non-rippable bedrock	moderate	cutbank erosion	poor	ruts	poor to fair	shallow soils	poor	shallow soils	fair	low volume
54-2D	moderate	slope	moderate	cutbank slough	good to poor	ruts	poor	moisture stress low fertility	poor	droughty	fair	soft materi low volume
54-2E	moderate	slope	moderate	cutbank slough	good to poor	ruts	fair	low fertility	fair	droughty	fair	soft materi low volume
54-3A	moderate	slope	slight		good to fair	slick when wet	poor to fair	shallow soils moisture stress	poor	steep slope	fair	low volume
54-3C	moderate	slope	slight		good to fair	slick when wet	fair	moisture stress low fertility	poor	steep slope	fair	low volume
54-3D	moderate	slope	slight		good to fair	slick when wet	fair to good	low fertility	poor	steep slope	fair	low volume
54-3E	moderate	slope	moderate	cutbank erosion	good to fair	slick when wet	fair	moisture stress short season	poor	steep slope	fair	low volume

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitation
54-3F	moderate	slope	moderate	cutbank erosion	good to fair	slick when wet	poor to fair	shallow soils low fertility	poor	steep slope	fair	low volume
54-5A	moderate	slope	slight		good to fair	slick when wet	fair	moisture stress low fertility	poor	steep slope	fair	excess fin
54-5C	moderate	slope	slight		good to fair	slick when wet	fair	moisture stress	poor	steep slope	fair	excess fin
61-2A	slight		slight		variable	ruts	fair	moisture stress low fertility	fair	many rocks	poor	excess fine
64-2A	slight		slight		variable		fair	moisture stress	variable		variable	
64-2C	moderate	wet areas	moderate	flooding	variable		good		variable		variable	
66-1A	severe	wet areas	severe	flooding shallow groundwater	variable		good		variable	water table	variable	
71-1A	moderate	wet areas	severe	cutbanks slough	poor	ruts	good		fair	low fertility	poor	excess fines
71-1B	slight		moderate	cutbank erosion	poor	ruts	fair	moisture stress	good		poor	excess fines
71-1C	moderate	wet areas	moderate	cutbanks slough	poor	ruts	fair to good	moisture stress short season	fair	low fertility	poor	excess fines

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
71-1D	slight		moderate	cutbanks slough	poor	ruts	fair to good	moisture stress low fertility	fair	low fertility	poor	excess fines
71-1E	slight		moderate	cutbanks slough	poor	ruts	fair to good	moisture stress short season	good		poor	excess fines
71-2A	moderate	wet areas	moderate	cutbanks slough	poor	ruts	good	—	fair	low fertility	poor	excess fines
71-2B	slight		moderate	cutbanks slough	poor	ruts	good		fair	low fertility	poor	excess fines
71-2C	slight		moderate	cutbanks slough	poor	ruts	fair	moisture stress short season	fair	low fertility	poor	excess fines
71-2D	slight		moderate	cutbanks slough	poor	ruts	fair	moisture stress low fertility	fair	low fertility	poor	excess fines
82-2B	slight		moderate	cutbanks slough	good to poor	ruts	fair to good	moisture stress	fair	low fertility	poor	excess fines
82-2C	slight		moderate	cutbanks slough	good to poor	ruts	fair to good	moisture stress short season	poor	water table	poor	excess fines
84-1A	moderate	slope	moderate	cutbanks slough	good to poor	ruts	good		good		fair	low volume
84-1B	moderate	slope	slight		good to poor	ruts	fair	moisture stress	good		fair	low volume
84-2B	slight		slight		fair	slick when wet	good		good		not suited	soft material

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
85-2A	severe	slope non-rippable bedrock	moderate	cutbank erosion	good		fair	moisture stress low fertility			fair	low volume
85-2B	moderate	slope	moderate	cutbank erosion	fair	rocky surface	poor to good	shallow soils	poor	many rocks	fair	low volume
85-3A	moderate	slope	moderate	cutbank erosion	fair	slick when wet	fair	moisture stress low fertility	fair	many rocks	fair	soft materia
85-3B	moderate	slope	moderate	cutbank erosion	fair	slick when wet	good		poor	low fertility	fair	soft materia
86-2A	slight		slight		poor	ruts	fair to good	moisture stress low fertility	fair	low fertility	poor	soft materia
86-2C	slight		slight		poor	ruts	fair	moisture stress low fertility	good		poor	soft materia
86-2D	moderate	wet areas	moderate	cutbanks slough	poor	ruts	good		poor	low fertility	poor	soft materia
86-2E	slight		moderate	cutbanks slough cutbank erosion	good to poor	ruts	fair	moisture stress short season	fair	low fertility	poor	soft materia low volume
86-3B	slight		slight		fair	slick when wet	fair to good	moisture stress low fertility	poor	low fertility	poor	soft materia

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
86-3C	slight		slight		fair	slick when wet	fair	moisture stress	good		poor	soft materia
87-1A	severe	slope	severe	cutbank erosion	fair	rocky surface	poor	shallow soils	poor	shallow soils	fair	soft materia
87-1A	severe	slope	severe	cutbank erosion	fair	rocky surface	poor	shallow soils short season	poor	shallow soils	fair	soft materia
		non-rippable bedrock		avalanche								
87-1B	severe	slope	severe	cutbank erosion	good to fair	rocky surface	poor to fair	moisture stress shallow soils	poor	steep slope	fair	soft materia
		non-rippable bedrock										
87-1D	severe	slope	moderate	cutbank erosion	fair	rocky surface	poor to fair	shallow soils	poor	steep slope	fair	soft materi
		non-rippable bedrock										
87-2A	moderate	slope	moderate	cutbank erosion	poor	ruts	fair	moisture stress low fertility	poor	steep slope	fair	low volume
87-2B	moderate	slope	moderate	cutbank erosion	poor	ruts	fair to good	moisture stress low fertility	poor	steep slope	fair	low volume
				avalanche								

TABLE 3: ROAD CONSTRUCTION, CONSTRUCTION MATERIALS, AND REVEGETATION OF DISTURBED AREAS

Map Unit Symbol	Excavation		Cut and Fill Maintenance		Native Road Surface		Revegetation of Disturbed Sites		Topsoil Source		Aggregate Source	
	Limitation	Kind	Limitation	Kind	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations	Suitability	Kinds of Limitations
87-2C	moderate	slope	moderate	cutbank erosion	poor	ruts	fair	moisture stress low fertility	poor	steep slope	fair	low volume
87-2D	moderate	slope	moderate	cutbank erosion	poor	ruts	fair		poor	steep slope	variable	
87-2E	moderate	slope	severe	cutbank erosion avalanche	poor	ruts	fair	moisture stress short season	poor	steep slope	variable	
88-1A	slight		slight		fair	slick when wet	fair	moisture stress low fertility	poor	low fertility	fair	soft material
88-2A	slight		slight		fair	slick when wet	fair	moisture stress low fertility	poor	low fertility	fair	soft material
91-2B	slight		moderate	cutbanks slough	poor	ruts	fair	moisture stress low fertility	fair	low fertility	fair	soft material low volume
93-1A	moderate	non-rippable bedrock	severe	cutbanks unravel avalanche	poor	rocky surface	poor	moisture stress short season	poor	droughty	good	

WATERSHED MANAGEMENT

The survey area contains a large portion of the headwaters of the Missouri River. The Missouri River drainage receives approximately 2,500,000-acre feet of water every year from the survey area. The quality of this water is presently very high. Most runoff occurs during late spring or early summer. Streamflow arising on the Forest is used to irrigate 439,000 acres of cropland and hayland in five counties. There are three major reservoirs on the Forest. The Hebgen Lake reservoir is used to regulate flow to generate power at the Madison Power Plant in Ennis, Montana. The other two reservoirs are a part of three municipal watersheds on the Forest. The survey area also has many waterlines, stock ponds, small reservoirs, and irrigation ditches.

Under natural conditions, these watersheds produce sediment at an estimated rate of 45 tons per square mile per year. Little runoff occurs on undisturbed litter covered forest soils because of their high infiltration rates. An exception at higher elevations occurs during spring melt of the deep snowpack, where surface runoff is common (Glasser 1982). Under current climatic conditions, most natural sediment is produced from stream channel bank erosion. These stream banks usually are formed in alluvium which is prone to transport during high water.

When soil is disturbed by management practices, runoff and consequent sheet and rill erosion can occur. In addition to surface erosion, landslides may occur more frequently. Not all management induced sheet and rill erosion or landslides reach a stream channel and become sediment. To evaluate the effects of management induced erosion on water quality, it is necessary to estimate the amount of eroded material which might enter a stream channel.

Table 4 PROPERTIES AFFECTING SEDIMENT YIELD rates properties of map units affecting erosion, landslide, and sediment delivery. Watershed scientists commonly use models which require these ratings for predicting sediment yield. These ratings can also be used to identify areas which require onsite evaluation during project planning. When a map unit contains land with variable ratings, the most restrictive is given.

Erodibility is a rating of the relative susceptibility of exposed soil to erosion by water. It can be used to evaluate the erosion hazard which results from combinations of specific land management practices and erosion control treatments. Erodible material may have a low or high erosion hazard depending upon the type of soil disturbance, the predicted effectiveness of erosion control treatments, and other site conditions.

Soil texture and rock fragment content are the most important properties affecting erodibility in the survey area. Soils rated low contain sufficient rock fragments to armor the surface of bared soil. They will normally have a low erosion hazard and do not require erosion control treatment when exposed. Soils rated moderate have loamy or clayey texture and contain few rock fragments. Erosion control treatment is normally required to control erosion of bared soil. The erosion hazard of these soils will vary with the nature of soil disturbance, the predicted effectiveness of planned erosion control practices, and other site conditions such as slope.

The ratings for the surface layer can be used to evaluate the erosion hazard for practices which result in baring the soil surface or exposure of soil layers within 24 inches of the surface. Logging skid trails, prescribed fire, and low standard roads are examples. The ratings for the substratum can be used to evaluate the erosion hazard for practices which require excavation and result in exposure of soil layers below 24 inches. Road cut and fill slopes are examples.

Landform sediment delivery efficiency is a rating of the relative probability of eroded soil reaching a stream channel and becoming sediment. It can be used in evaluating the hazard to water quality resulting from erosion. Overland transport of eroded soil is a complex process affected by many properties which must be evaluated onsite. These ratings consider properties of landforms which affect sediment delivery. Slope steepness, slope shape, and drainage channel density were the most important properties used to make these ratings.

Map units rated very low are nearly level or gently sloping and contain no surface drainage channels. Detached soil is normally stabilized close to its source and is unlikely to become stream sediment.

Map units rated low have gentle slopes and widely spaced stream channels. Soil erosion which occurs adjacent to stream channels may become sediment but the major portion of the map unit is far enough from stream channels that transported soil is stabilized before it becomes sediment.

A moderate rating indicates moderate to steep slopes and stream channels 800 to 2,500 feet apart. Some planned soil disturbing practices will probably occur near enough to stream channels for soil erosion to produce sediment. Onsite evaluation of erosion and sediment hazards should be considered.

A high rating indicates steep slopes and stream channels less than 800 feet apart. Almost all planned soil disturbing practices occur near enough to stream channels for soil erosion to produce sediment. Onsite evaluation of erosion and sediment hazards should be considered. When erosion hazards are moderate or high, some short-term increase in sediment may be unavoidable.

Landslide potential is a rating of the relative probability of downslope movement of masses of soil and rock materialunder natural or non-managed conditions. The most common kinds of landslides which occur in the survey area are rotational slumps and landflows. They are usually associated with concentrations of groundwater above a layer with restricted permeability. The ratings can be used to compare the relative probability of landslides occurring on alternative areas being considered in plans and for determining which areas should have onsite evaluation of slope stability when designing a project. The ratings are based on observations of landslides in the survey area and their association with combinations of observable properties of map units. Slope steepness, indicators of groundwater concentrations such as seeps and water loving vegetation; bedrock properties; and evidence of landslides occurring in the past such as cracks, leaning trees and hummocky topography were properties used to make the ratings.

Map units rated very low have no properties associated with landslides.

Map units rated low have some properties associated with landslides on less than 20 percent of the area. Landslide hazards will not normally affect the location or design of projects for units rated very low or low.

Map units rated moderate contain all the properties associated with landslides on 20-40 percent of the area.

Map units rated high contain all the properties associated with landslides on over 40 percent of the area. Map units rated moderate or high may require that landslide hazards be evaluated onsite before locating projects.

Table 5 FEASIBILITY OF CONTROLLING SEDIMENT YIELD rates the relative feasibility of controlling sediment from road construction and logging. It can be used in planning to compare the relative hazards to water quality from logging and road construction on alternative land areas. For specific road locations and sale areas it can be used to identify areas where intensive erosion and sediment control measures may be necessary. Comparisons are made only among map units in this survey area, so ratings of similar map units in another survey area may differ.

The ratings are based on a system developed for this survey area that included consideration of (1) a standard sediment yield from common practices, (2) the effectiveness and relative cost of treatments for controlling erosion and sediment, and (3) any increase in sediment above the standard which cannot be controlled by using practices which are technically feasible and whose cost is not prohibitive. The ratings assume that soil disturbance in and adjacent to stream channels is minimized. Projects which involve extensive disturbance of stream channels and their banks should be evaluated onsite to determine the sediment hazard involved.

The standard sediment yield assumes stable landforms, soil erosion control by erosion control seedings of mixtures of domestic grasses and legumes, and diversion of runoff water by drainage structures.

Feasibility of controlling sediment resulting from soil erosion and landslides is rated separately. These two potential sources of sediment require different control practices. Landslide control is commonly more difficult than erosion control and normally involves identification of unstable slopes within the project area and avoiding disturbance that is likely to increase the hazard.

A high feasibility rating indicates erodibility, landslide potential, and sediment delivery efficiency are all low. Sediment is held at standard levels or below by standard practices.

A moderate feasibility rating for sediment from soil erosion indicates erodible soils on landforms with moderate or high sediment delivery efficiency. Sediment increases above standard are normally confined to the first several years after disturbance before erosion control seedings become effective. A moderate rating for sediment from landslides indicates a moderate landslide potential requiring special location and design precautions.

A low feasibility rating for controlling sediment from soil erosion indicates erodible soils on landforms with moderate or high sediment delivery efficiency. Sediment increases above standard are generally long-term because of limitations to establishment of erosion control seedings. Control normally requires structural practices such as mulch, sediment traps, or armoring bare soils with rock. A low sediment control rating for landslides indicates a practically unavoidable hazard of increasing the occurrence of landslides.

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
12-1A	low	low	very low	very low
12-1C	low	low	very low	very low
12-2A	low	low	very low	low
12-2B	low	low	low	low
13-1A	moderate	moderate	very low	very low
13-2A	moderate	moderate	low	low
22-1A	moderate	moderate	moderate	very low
22-1B	low	moderate	moderate	very low
22-1C	low	moderate	moderate	low
22-2A	moderate	moderate	moderate	high
22-3A	low	low	high	moderate
22-3C	moderate	moderate	moderate	low
25-1A	low	moderate	high	very low
25-3A	low	low	moderate	low
34-1A	low	moderate	low	low
34-1B	low	low	very low	very low
34-1C	low	moderate	low	very low

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
34-1D	low	low	low	very low
34-2C	moderate	moderate	moderate	moderate
34-2D	moderate	moderate	low	moderate
34-3A	low	low	moderate	low
34-3B	low	low	moderate	low
34-4B	low	low	moderate	low
34-4C	moderate	moderate	low	low
35-1A	low	moderate	moderate	low
35-1B	low	moderate	low	very low
35-1C	low	moderate	moderate	very low
35-2C	moderate	moderate	moderate	moderate
35-3A	low	low	moderate	moderate
35-3B	low	low	moderate	moderate
35-4C	moderate	moderate	low	low
46-1B	low	low	low	very low
46-2A	low	low	low	low
46-3A	moderate	moderate	very low	very low

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
53-1A	low	low	low	very low
53-1D	low	low	moderate	low 1/
53-3A	low	low	moderate	low
53-3B	moderate	moderate	moderate	low
53-3C	moderate	moderate	moderate	low
54-1A	low	low	moderate	low
54-1B	low	moderate	high	very low
54-1C	low	moderate	moderate	low
54-1E	low	moderate	high	low
54-1G	low	low	moderate	low
54-2B	low	low	high	low
54-2C	low	low	moderate	low 1/
54-2D	moderate	moderate	high	high
54-2E	low	low	moderate	moderate
54-3A	low	low	moderate	moderate
54-3C	low	low	moderate	low
54-3D	moderate	moderate	moderate	moderate

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
54-3E	low	low	high	low
54-3F	low	low	high	very low
54-5A	low	low	high	low
54-5C	low	low	high	low
61-2A	low	low	low	very low
64-2A	low	low	very low	very low
64-2C	low	low	very low	very low
66-1A	variable	variable	moderate	very low
71-1A	moderate	moderate	moderate	high
71-1B	moderate	moderate	low	moderate
71-1C	moderate	moderate	moderate	high
71-1D	moderate	moderate	low	moderate
71-1E	moderate	moderate	low	moderate
71-2A	moderate	moderate	moderate	high
71-2B	moderate	moderate	moderate	low
71-2C	moderate	moderate	moderate	moderate
71-2D	moderate	moderate	low	low

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
82-2B	moderate	moderate	moderate	moderate
82-2C	moderate	moderate	moderate	moderate
84-1A	moderate	moderate	moderate	moderate
84-1B	moderate	moderate	low	moderate
84-2B	low	low	moderate	low
85-2A	low	low	moderate	very low
85-2B	low	low	moderate	low
85-3A	low	low	moderate	very low
85-3B	low	low	moderate	very low
86-2A	moderate	moderate	moderate	moderate
86-2C	moderate	moderate	low	moderate
86-2D	moderate	moderate	low	moderate
86-2E	moderate	moderate	high	moderate
86-3B	moderate	moderate	low	low
86-3C	moderate	moderate	low	very low
87-1A	low	moderate	moderate	low
87-1B	low	moderate	moderate	low

TABLE 4: PROPERTIES AFFECTING SEDIMENT YIELD

Map Unit Symbol	Erodibility		Landform Sediment Delivery Efficiency	Potential for Landslides
	Surface Layer	Substratum		
87-1D	low	moderate	low	low
87-2A	moderate	moderate	moderate	moderate
87-2B	moderate	moderate	moderate	moderate
87-2C	moderate	moderate	moderate	moderate
87-2D	low	low	moderate	moderate
87-2E	moderate	moderate	high	moderate
88-1A	low	low	very low	very low
88-2A	low	low	low	very low
91-2B	low	low	low	moderate
93-1A	moderate	moderate	very low	very low

1/ Hazards in drainageways are "moderate."

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
12-1A	high	high	high	high
12-1C	high	high	high	high
12-2A	high	high	high	high
12-2B	high	high	high	high
13-1A	high	——	high	——
13-2A	high	——	high	——
22-1A	moderate	moderate	moderate	high
22-1B	moderate	moderate	moderate	high
22-1C	moderate	——	moderate	——
22-2A	moderate	moderate	low	low
22-3A	moderate	moderate	low	moderate
22-3C	moderate	moderate	moderate	high
25-1A	low	——	high	——
25-3A	low	——	moderate	——
34-1A	moderate	high	high	high

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
34-1B	high	——	high	——
34-1C	moderate	high	high	high
34-1D	moderate	high	high	high
34-2C	moderate	moderate	low	moderate
34-2D	moderate	high	low	moderate
34-3A	moderate	high	moderate	high
34-3B	moderate	high	moderate	high
34-4B	moderate	high	moderate	high
34-4C	high	——	high	——
35-1A	very low	moderate	moderate	high
35-1B	moderate	——	high	——
35-1C	low	moderate	high	high
35-2C	moderate	moderate	low	low
35-3A	moderate	high	moderate	high
35-3B	moderate	high	moderate	high

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
35-4C	high	——	high	——
46-1B	high	——	high	——
46-2A	high	——	high	——
46-3A	high	high	high	high
53-1A	high	moderate	high	high
53-1D	moderate	moderate	high	high
53-3A	moderate	——	moderate	——
53-3B	moderate	high	moderate	high
53-3C	high	high	moderate	high
54-1A	low	——	moderate	——
54-1B	low	low	moderate	high
54-1C	moderate	moderate	moderate	high
54-1E	low	low	moderate	moderate
54-1G	low	moderate	moderate	high
54-2B	moderate	moderate	moderate	moderate

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
54-2C	low	moderate	moderate	moderate
54-2D	moderate	moderate	low	low
54-2E	low	moderate	low	low
54-3A	moderate	——	moderate	——
54-3C	high	high	low	moderate
54-3D	high	moderate	moderate	moderate
54-3E	moderate	moderate	moderate	moderate
54-3F	high	moderate	moderate	moderate
54-5A	high	high	moderate	moderate
54-5C	moderate	high	moderate	moderate
61-2A	high	——	high	——
64-2A	high	high	high	high
64-2C	high	high	high	high
66-1A	moderate	——	moderate	——
71-1A	moderate	high	low	low

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
71-1B	high	——	low	——
71-1C	low	moderate	low	low
71-1D	high	high	low	moderate
71-1E	high	high	moderate	high
71-2A	high	high	low	low
71-2B	high	high	moderate	moderate
71-2C	high	high	low to moderate	low
71-2D	high	high	moderate	high
82-2B	moderate	high	low	low
82-2C	moderate	moderate	low	low
84-1A	low	moderate	low	low
84-1B	high	——	moderate	——
84-2B	moderate	high	high	high
85-2A	moderate	moderate	moderate	high
85-2B	moderate	moderate	moderate	high

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
85-3A	high	high	moderate	high
85-3B	moderate	high	moderate	high
86-2A	moderate	moderate	moderate	high
86-2C	moderate	——	moderate	——
86-2D	moderate	moderate	low	low
86-2E	low	low	low	low
86-3B	moderate	high	moderate	high
86-3C	high	——	moderate	——
87-1A	moderate	——	moderate	——
87-1B	high	——	moderate	——
87-1D	moderate	moderate	high	high
87-2A	high	moderate	low	low
87-2B	moderate	moderate	low	low
87-2C	moderate	——	low	——
87-2D	moderate	moderate	low	low

TABLE 5: FEASIBILITY OF CONTROLLING SEDIMENT

Map Unit Symbol	Feasibility of Controlling Sediment from Soil Erosion		Feasibility of Controlling Sediment from Landslides	
	Roads	Logging	Roads	Logging
87-2E	very low	——	very low	——
88-1A	high	high	high	high
88-2A	high	high	high	high
91-2B	moderate	high	low	low
93-1A	high	——	high	——

TIMBER

About 75 percent of the survey area is forested. Currently, 36 percent of forested lands are classified as capable and available for timber management.

The principal commercial species are lodgepole pine, Douglas-fir, subalpine fir, and spruce. The annual programed sell for the last 20 years ranged from 9 to 67 million board feet, averaging 38 million board feet. A sale program to salvage lodgepole pine threatened by mountain pine beetle was started in 1978.

Table 6 TIMBER PRODUCTIVITY AND MANAGEMENT can be used by forest managers in planning the use of map units for the production of wood products. The table is divided into three sections; vegetation composition, potential productivity, and management limitations.

A Vegetative Group is a grouping of habitat types with broadly similar properties. They reflect the climatic zones in mountains that result from variation in elevation, slope, and aspect. They are described in the vegetation section of the General Nature of the Survey Area. Rock outcrop and minor vegetation groups are not included in the percentages.

Potential productivity is the amount of wood fiber that can be produced from managed forests. It is expressed in cubic feet per acre per year. The yields were taken from Pfister, (1977) and are adjusted to reflect the influence of soil and site conditions observed during the survey.

The following soil and site conditions limit potential productivity: short growing season, harsh climatic conditions, stocking restriction due to either rock outcrop or vegetative competition, and low soil fertilty or water holding capacity.

Management limitations rates the limitation to equipment operation, regeneration, and windthrow hazards. Equipment rates the limitation to the use of crawler tractors or rubber tired skidders. Properties considered limiting are slope steepness, occurrence of rock outcrop, surface layers which rut and compact when opeated on under normal moisture conditions, occurrence of wet sites, and thin surface layers highly important to site productivity which may be disturbed by equipment operation. Only the most restrictive limitations are listed.

A rating of severe indicates that limitations are generally too restrictive for equipment use. The limitation can not be overcome by managing equipment use. The expected performance of equipment is very poor. Aerial or cable systems can overcome this limitation.

A rating of moderate indicates that limitations do not prevent equipment use. The limitation can be overcome by controlling the time, location, or intensity of equipment operation. The expected performance of equipment is fair to good.

A rating of slight indicates that limitations do not restrict equipment use. The expected performance of equipment is good.

Regeneration rates the limitation to natural regeneration. Moisture stress, wind desiccation and competition are considered limiting. Only the most restrictive limitation is listed.

A severe rating indicates the limitation is difficult to overcome. The rating is used for open grown forests at low elevation in which moisture stress limits regeneration to those years with above average spring and summer precipitation. Local experience indicates they occur every 15 to 20 years. It is also used for timberline forest where strong winds desiccate seedlings and for forest surrounded by grasslands where competition and moisture stress limit regeneration.

A moderate rating indicates the limitation can be overcome by the use of special harvest and site preparation practices or by planting. The rating is used where understory vegetation competes vigorously with seedlings or where wind desiccation or moisture stress may delay regeneration for more than 5 years.

A slight rating indicates that site properties are favorable for regeneration. The selection of harvest methods and site preparation practices is not influenced by any unusual limitation to regeneration.

Windthrow hazards rates the potential for trees to blow over after a harvest entry in an old growth stand. The rating can be used to determine where cutting unit design and the selection of silvicultural systems may have to be modified to reduce mortality because of windthrow in the remaining stand. The rating considers soil properties which affect how firmly roots are held and topographic position which affects exposure to the wind. Soil properties considered are depth, texture, and depth to water tables. Shallow soils, coarse textured soils, and high water tables may increase windthrow hazard.

Ridgetops and steep south or west facing slopes are considered to be most exposed to the prevailing winds.

A high rating indicates soil properties favorable for windthrow and/or ridgetops or steep south or west facing slopes. Some mortality from windthrow is probable even when cutting units and silvicultural systems are designed to minimize the hazard.

A moderate rating indicates there are some soil properties favorable for windthrow in topographic positions partially protected from the prevailing winds. Properly designed cutting units and silvicultural systems will generally prevent windthrow mortality.

A low rating indicates soil conditions unfavorable for windthrow or topographic positions protected from the prevailing winds. No special precautions are necessary to prevent windthrow mortality.

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
12-1A	upper subalpine forest (70%)	24 ± 8	harsh climate; fertility	slight	moderate: wind desiccation	high
	lower subalpine forest (20%)	43 ± 10				
12-1C	lower subalpine forest	43 ± 10	droughty site	slight	moderate: moisture stress; competition	high
12-2A	lower subalpine forest (75%)	62 ± 9	none	slight	none	high
	upper subalpine forest (20%)	41 ± 9				
12-2B	upper subalpine forest (70%)	24 ± 8	harsh climate	slight	moderate: wind desiccation	high
	lower subalpine forest (20%)	43 ± 10				
13-1A	alpine turfs and meadow	———	———	———	———	———
13-2A	alpine turfs and meadow	———	———	———	———	———
22-1A	lower subalpine forest and upper subalpine forest	34 ± 19	droughty site stocking restriction	severe: slope	moderate: moisture stress	
22-1B	open-grown forest (30%)	21 ± 5	droughty site	severe: slope	severe: competition; moisture stress	moderate
	mountain grassland (20%) lower subalpine forest (20%)	49 ± 5	stocking restriction; droughty site	severe: slope	severe: competition; moisture stress	high

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
22-1C	timberline forest (10-50%) alpine turfs and meadow (0-50%)	< 20	harsh climate	severe: slope	severe: moisture stress; wind dessication	high
22-2A	lower subalpine forest (50%) mountain meadow (15%)	62 ± 9	stocking restriction	severe: slope	slight	moderate
22-3A	lower subalpine forest (50%) dense Douglas-fir forest (15%)	43 ± 10 56 ± 8	harsh climate	severe: slope	slight	moderate
22-3C	lower subalpine forest (65-85%) upper subalpine forest (5-20%)	62 ± 9 41 ± 9	harsh climate	moderate: wet areas	moderate: wind desiccation	high
25-1A	alpine turfs and meadow (45-70%) timberline forest (10-20%)	< 20	harsh climate	slight	severe: moisture stress; wind dessication	low
25-3A	alpine turfs and meadow (45%) timberline forest (30%)	< 20	harsh climate	slight	severe: moisture stress; wind dessication	low
34-1A	upper subalpine forest	24 ± 8	harsh climate; soil fertility	slight	slight	moderate
34-1B	mountain shrubland (75%) open-grown forest (10%)	17 ± 4	droughty site	slight	severe: moisture stress	low
34-1C	lower subalpine forest	62 ± 9	droughty site	none	slight	moderate

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
34-1D	dense Douglas-fir forest (55%)	33 ± 18	droughty site	slight	moderate: moisture stress; competition	low
	open-grown forest (25%)	21 ± 9	droughty site	slight	severe: moisture stress; competition	low
34-2C	upper subalpine forest (60%)	41 ± 9	growing season; stocking restriction	moderate: rutting-compaction	slight	moderate
	mountain meadow (35%)	——	——	——	——	——
34-2D	lower subalpine forest (65%)	58 ± 13	none	moderate: rutting-compaction	moderate: competition	low
	mountain meadow (35%)	——	——	——	——	——
34-3A	upper subalpine forest	33 ± 17	growing season	sight	moderate: wind desiccation	moderate
34-3B	lower subalpine forest	62 ± 9	none	slight	none	moderate
34-4B	lower subalpine forest	62 ± 9	stocking restriction	slight	slight	low
34-4C	mountain shrubland (75%)	——	——	——	——	——
	dense Douglas-fir forest (25%)	42 ± 5	droughty site: stocking restriction	sight	severe: moisture stress; competition	low
35-1A	upper subalpine forest	24 ± 8	harsh climate: soil fertility	moderate: slope	moderate: wind desiccation	moderate
35-1B	mountain shrubland	——	——	——	——	——

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
35-1C	lower subalpine forest	48 ± 15	droughty site	moderate: slope	moderate: moisture stress	moderate
35-2C	lower subalpine forest (70%)	62 ± 5	stocking restriction	moderate: slope; rutting-compaction	slight	moderate
	mountain meadow (20%)	——	——	——	——	——
35-3A	upper subalpine forest (70%)	33 ± 17	growing season	moderate: slope; rutting-compaction	moderate: wind desiccation	moderate
	mountain meadow (15%)	——	——	——	——	——
35-3B	lower subalpine forest	65 ± 16	none	moderate: slope; rutting-compaction	slight	moderate
35-4C	mountain shrubland (70%)	——	——	——	——	——
	dense Douglas-fir forest (20%)	30 ± 14	droughty site	moderate: slope	severe: moisture stress; competition	low
46-1B	mountain shrubland (75%)	——	——	——	——	——
	mountain grassland (15%)	——	——	——	——	——
46-2A	mountain grassland (45%)	——	——	——	——	——
	mountain shrubland (35%)	——	——	——	——	——
	dense Douglas-fir forest (20%)	41 ± 5	droughty site; stocking restriction	none	severe: moisture stress; competition	low
46-3A	dense lodgepole pine forest	34 ± 11	droughty site; soil fertility	severe: thin surface layers	severe: moisture stress; fragile soils	high

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		
		Growth	Limitations	Equipment	Natural Regeneration	Windthrow Hazards
53-1A	mountain grassland (35%)	———	———	———	———	———
	mountain shrubland (25%)	———	———	———	———	———
	dense Douglas-fir forest (15%)	41 ± 5	droughty site; stocking restriction	slight	severe: moisture stress; competition	low
53-1D	lower subalpine forest	61 ± 8	none	moderate: wet areas; rutting-compaction	slight	low
53-3A	mountain shrubland (40%)	———	———	———	———	———
	mountain grassland (35%)	———	———	———	———	———
53-3B	lower subalpine forest (50%)	72 ± 18	none	slight	slight	moderate
	dense Douglas-fir forest (45%)	27 ± 14	droughty site; stocking restriction	slight	severe: moisture stress; competition	low
53-3C	lower subalpine forest	62 ± 9	none	slight	slight	low
54-1A	mountain grassland (35%)	———	———	———	———	———
	mountain shrubland (35%)	———	———	———	———	———
54-1B	lower subalpine forest and dense Douglas-fir forest	34 ± 18	droughty site rock outcrop	severe: slope; rock outcrop	severe: moisture stress; competition	moderate

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
54-1C	dense Douglas-fir forest(45%)-N	42 ± 6	droughty site	severe: slope	moderate: moisture stress; competition	moderate
	open-grown forest (30%) -S	21 ± 5	droughty site	severe: slope	severe: moisture stress; competition	low
54-1E	upper subalpine forest	24 ± 8	growing season; soil fertility	severe: slope; rock outcrop	moderate: moisture stress; wind desiccation	high
54-1G	lower subalpine forest (60%)-N	69 ± 16	none	severe: slope	slight	moderate
	dense Douglas-fir forest(15%)-S	41 ± 6	droughty site; stocking restriction	severe: slope	severe: moisture stress; competition	low
54-2B	dense Douglas-fir forest (25%)	32 ± 16	droughty site; stocking restriction	severe: slope; rock outcrop	severe: moisture stress; competition	moderate
	mountain grassland (25%)	———	———	———	———	———
54-2C	lower subalpine forest	48 ± 15	droughty site; stocking restriction	severe: slope; rock outcrop	moderate: moisture stress	moderate
54-2D	mountain grassland (45%)	———	———	———	———	———
	dense Douglas-fir forest (30%)	32 ± 16	droughty site; stocking restriction	severe: slope	severe: moisture stress; competition	low
54-2E	lower subalpine forest	61 ± 9	none	severe: slope	slight	low

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
54-3A	mountain grassland (40%)	———	———	———	———	———
	mountain shrubland (35%)	———	———	———	———	———
54-3C	dense Douglas-fir forest (30%)	32 ± 16	droughty site; stocking restriction	severe: slope	moderate: moisture stress; competition	———
	mountain grassland (20%)	———	———	———	———	———
54-3D	lower subalpine forest (55%)	62 ± 8	none	severe: slope	slight	moderate
	dense Douglas-fir forest (20%)	64 ± 11				
54-3E	upper subalpine forest (65%)	24 ± 8	growing season	severe: slope	moderate: wind desiccation	moderate
	lower subalpine forest (25%)	62 ± 9				
54-3F	lower subalpine forest (30%)	50 ± 14	growing season; stocking restriction	severe: slope; rock outcrop	moderate: moisture stress; competition	high
	upper subalpine forest (15%)	24 ± 8	growing season	severe: slope; rock outcrop	moderate: moisture stress; wind dessication	low
54-5A	dense Douglas-fir forest(35%)-N	51 ± 9	none	severe: slope	moderate: competition; moisture stress	low
	open-grown forest (30%) -S	21 ± 5	droughty site	severe: slope	severe: competition; moisture stress	low
54-5C	dense Douglas-fir forest(50%)-N	51 ± 9	none	severe: slope; rock outcrop	moderate: competition	moderate
	open-grown forest (15%)	21 ± 5	droughty site	———	severe: competition; moisture stress	low

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
61-2A	mountain grassland (30%)	——	——	——	——	——
	mountain shrubland (30%)	——	——	——	——	——
	open-grown forest (30%)	21 ± 5	droughty site	slight	severe: moisture stress; competition	low
64-2A	mountain shrubland (30%)	——	——	——	——	——
	mountain shrubland (30%)	——	——	——	——	——
	open-grown forest (30%)	21 ± 5	droughty site	slight	severe: moisture stress; competition	low
64-2C	lower subalpine forest	81 ± 16	none	moderate: rutting-compaction; wet areas	slight	high
66-1A	riparian hardwoods	——	——	——	——	——
71-1A	lower subalpine forest (75%)	71 ± 19	none	severe: rutting-compaction; wet areas	slight	high
	mountain meadow (15%)	——	——	——	——	——
71-1B	mountain grassland (30%)	——	——	——	——	——
	mountain shrubland (30%)	——	——	——	——	——
	lower subalpine forest (20%)	60 ± 8	stocking restriction	moderate: rutting-compaction	slight	high
71-1C	upper subalpine forest (85%)	41 ± 9	growing season	severe: rutting-compaction; wet areas	moderate: wind desiccation	high
	mountain meadow (15%)	——	——	——	——	——
71-1D	lower subalpine forest	62 ± 9	none	moderate: rutting-compaction	moderate: competition	moderate

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
71-1E	dense Douglas-fir forest (45%)	65 ± 11	stocking restriction	moderate: rutting-compaction	moderate: competition	moderate
	lower subalpine forest (30%)	60 ± 8	stocking restriction	moderate: rutting-compaction	slight	high
	mountain grassland (15%)	——				
71-2A	lower subalpine forest	76 ± 10	none	moderate: rutting-compaction; wet areas	slight	high
71-2B	lower subalpine forest (85%)	62 ± 9	stocking restriction	slight	slight	low
	mountain meadow (15%)	——				
71-2C	upper subalpine forest (55%)	41 ± 9	growing season	moderate: rutting-compaction	moderate: wind desiccation	high
	lower subalpine forest (30%)	62 ± 9	none		slight	low
	mountain meadow (15%)	——				
71-2D	mountain shrubland (40%)	——				
	dense Douglas-fir forest (75%)	61 ± 14	stocking restriction	moderate: rutting-compaction	moderate: moisture stress; competition	low
	mountain grassland (20%)	——				
82-2B	lower subalpine forest	61 ± 9	none	slight	slight	moderate
82-2C	upper subalpine forest (70%)	41 + 9	growing season	moderate: rutting-compaction	moderate: wind desiccation	moderate
	lower subalpine forest (15%)	49 ± 9				

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		
		Growth	Limitations	Equipment	Natural Regeneration	Windthrow Hazards
84-1A	dense Douglas-fir forest (30%)	56 ± 9	none	moderate: rutting-compaction	slight	moderate
	lower subalpine forest (30%)	61 ± 8	none	moderate: rutting-compaction	slight	moderate
	mountain meadow (15%)	——	——	——	——	——
84-1B	mountain grassland (50%)	——	——	——	——	——
	mountain shrubland (30%)	——	——	——	——	——
84-2B	lower subalpine forest (60%)	61 ± 8	none	slight	slight	moderate
	mountain grassland (20%)	——	——	——	——	——
	dense Douglas-fir forest (15%)	56 ± 8	stocking restriction	slight	moderate: competition	low
85-2A	open-grown forest (40%) -S	21 ± 5	droughty site	severe: slope	severe: moisture stress; competition	low
	dense Douglas-fir forest(25%)-N	43 ± 7	droughty site	severe: slope	moderate: moisture stress; competition	moderate
85-2B	lower subalpine forest (45%)-N	43 ± 9	droughty site	severe: slope	moderate: moisture stress; competition	high
	dense Douglas-fir forest(30%)-S	43 ± 7				
85-3A	dense Douglas-fir forest (40%)	45 ± 19	droughty site	severe: slope	severe: moisture stress; competition	low
	mountain grassland (15%)	——	——	——	——	——
	mountain shrubland (15%)	——	——	——	——	——
85-3B	lower subalpine forest (60%)	61 + 8	stocking restriction	severe: slope	moderate: competition	moderate
	dense Douglas-fir forest (20%)	45 ± 19	moderate: available soil moisture	severe: slope	severe: moisture stress; competition	low

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
86-2A	lower subalpine forest (45%)	61 ± 8	stocking restriction	slight	slight	moderate
	mountain meadow (30%)	——	——	——	——	——
86-2C	mountain grassland (45%)	——	——	——	——	——
	mountain shrubland (40%)	——	——	——	——	——
86-2D	lower subalpine forest (60%)	62 ± 9	none	slight	slight	moderate
	upper subalpine forest (15%)	41 ± 9				
86-2E	mountain meadow (45%)	——	——	——	——	——
	upper subalpine forest (35%)	< 20	harsh climate	slight	moderate: wind dessication	low
86-3B	lower subalpine forest (60%)	61 ± 8	none	slight	slight	moderate
	dense Douglas-fir forest (25%)	56 ± 8	none	slight	slight	low
86-3C	mountain shrubland (55%)	——	——	——	——	——
	mountain grassland (30%)	——	——	——	——	——
87-1A	timberline forest (20-40%)	< 20	harsh climate	severe: slope	severe: wind dessication	low
	alpine turfs and meadow (10-20%)	——	——	——	——	——
87-1B	mountain grassland (50%)	——	——	——	——	——
	mountain shrubland (25%)	——	——	——	——	——
87-1D	lower subalpine forest	46 ± 6	droughty site	severe: slope	moderate: moisture stress; competition	moderate

TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
87-2A	open-grown forest (50%) -S	21 ± 5	droughty site	severe: slope	severe: moisture stress; competition	low
	mountain grassland (25%) -S	——	——	——	——	——
	dense Douglas-fir forest(15%)-N	56 ± 8	stocking restriction	severe: slope	moderate: moisture stress; competition	low
87-2B	dense Douglas-fir forest(45%)-N	56 ± 8	stocking restriction	severe: slope	slight	moderate
	lower subalpine forest (25%)-N	62 ± 9	none	severe: slope	slight	moderate
	open-grown forest (15%) -S	21 ± 5	droughty site	severe: slope	slight	low
87-2C	mountain grassland (40%)	——	——	——	——	——
	dense Douglas-fir forest (25%)	42 ± 6	droughty site stocking restriction	severe: slope	moderate: moisture stress; competition	low
	mountain shrubland (20%)	——	——	——	——	——
87-2D	lower subalpine forest	66 ± 14	none	severe: slope	slight	high
87-2E	upper subalpine forest (40%)	< 20	harsh climate	severe: slope	severe: wind dessication	low
	mountain meadow (20%)	——	——	——	——	——
	lower subalpine forest (20%)	43 ± 10	growing season	severe: slope	moderate: wind desiccation	high
88-1A	lower subalpine forest	43 ± 10	droughty site; low soil fertility	moderate: thin surface layer	moderate: moisture stress; competition	high
88-2A	lower subalpine forest	43 ± 10	droughty ~~silts~~ site; low soil fertility	none	severe: competition	moderate

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TABLE 6: TIMBER PRODUCTIVITY AND MANAGEMENT

TABLEB TAB6-13

Unit Symbol	Vegetative Group	Potential Productivity (cu. ft./ac./year)		Management Limitations		Windthrow Hazards
		Growth	Limitations	Equipment	Natural Regeneration	
91-2B	lower subalpine forest (55%)	61 + 8	stocking restriction	moderate: rutting-compaction	moderate: competition	high
	mountain meadow (20%)	——	——	——	——	——
	upper subalpine forest (20%)	41 ± 9	stocking restriction	moderate: rutting-compaction	moderate: wind desiccation	moderate
93-1A	alpine turfs and meadow (5-30%)	——	——	——	——	——
	timberline forest (5-30%)	< 20	harsh climate	severe: slope	severe: wind dessication	low

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RANGE

The Gallatin National Forest area provides summer range for livestock from adjoining farms and ranches. The survey area provides approximately 69,000 AUM's (Animal Unit Months) of grazing. Most of the livestock are cattle, but a few bands of sheep graze higher elevation ranges. The grazing season generally begins in mid June and ends in mid-September, but varies with elevation. Most ranges contain mountain grasslands, shrublands, and meadows. Open growing forests with bunchgrass understories also provide important range. Densely forested areas may be used as transitory range following timber harvest or forest fires. Removal of the forest canopy may stimulate understory forage production. Production on transitory ranges peaks about 11 years after canopy removal and then declines as the forest regenerates and the canopy closes.

Table 7 POTENTIAL FOREST UNDERSTORY PRODUCTIVITY gives the potential forage productivity of forest understory vegetation. It can be used to evaluate the transitory range potential of forested areas.

A Vegetative Group is a grouping of vegetative types with broadly similar properties. They reflect the climatic zones in mountains that result from variation in elevation, slope, and aspect. They are described in the vegetation section of the General Nature of the Survey Area.

Under Forest Canopy gives the productivity of the understory in the shade of a forest canopy in pounds per acre per year for grass, forbs, and shrubs.

Total livestock forage is the portion of total production palatable to livestock. The shrub component is not included in forage. Ten percent of the forb component is included and the percentage of the grass component varies with species composition. Production is based on unpublished data from the adjacent Madison County Soil Survey and Basile (1974). Palatability was derived from Forest Service and Soil Conservation Service range analysis handbooks and consultation with Forest Service and Montana State University range conservationists.

After Forest Canopy is Removed is the maximum potential productivity in timber harvest areas and burns approximately 11 years after removal of the overstory. Productivity is based on production in the shade of a canopy adjusted using factors developed by Basile (1974). These factors take into account changes in understory vegetation composition after canopy removal. Both vegetative groups and water holding capacity of the soil surface layer are considered in the rating.

Total Livestock Forage was computed for conditions under a forest canopy. Palatability of the forb component was assumed to be 20 percent based on unpublished data by Mueggler and Stewart.

RANGE MANAGEMENT

Table 8 gives the potential productivity of rangelands in normal years and limitations to grazing by livestock. It can be used to compare the relative suitability of map units for livestock grazing.

Vegetative Group is a grouping of vegetative types with broadly similar properties. They reflect the climatic zones in mountains that result from variation in elevation, aspect, and slope. They are described in the vegetation section of the General Nature of the Soil Survey Area.

Range Site - Soil Groups are distinctive rangeland soils that have different water holding capacity or available soil moisture (Soil Conservation Service, 1971). These soil groups produce a characteristic natural plant community that differs from those on other soil groups in kind, amount, and proportion of range plants. Forested units are not assigned range site-soil groups.

Potential productivity is the amount of annual growth on a well managed range in a normal year. It includes all growth regardless of palatibility to livestock. It includes current years growth of leaves, twigs, and fruits of woody plants. It is expressed as pounds per acre of air dry vegetation. In good years, the production of mountain grasslands and shrublands increases approximately 60 percent over a normal year. Mountain meadows and alpine turfs increase approximately 30 percent. In poor years, all production decreases approximately 20 percent. The potential productivity of forested sites for transitory range forage is repeated from table 7.

Livestock grazing limitations rate the degree and kind of limitations to livestock grazing. Any of several properties may limit livestock grazing. Forage productivity may be low on forested sites used as transitory range following timber harvest or fire. Slopes may be so steep that livestock tend to concentrate on small areas of included gentler slopes. Forage production may be scattered in small meadows surrounded by forests which produce little forage. Under these conditions livestock tend to overutilize some areas and not use others. At high elevations grazing seasons are short. Forage is often not ready for grazing until early summer and early fall snow storms force livestock to lower elevations.

A slight limitation indicates that properties are favorable for livestock grazing. Limitations are easily overcome by common range management practices. Map units rated slight have slopes less than 30 percent, potential forage production greater than 400 pounds per acre per year on more than 50 percent of the area and are below 8,000 feet elevation.

A moderate limitation indicates that one or more properties are unfavorable for livestock grazing. Map units rated moderate because of slope have dominant slopes of >30 ~~45~~ percent. Those with short season are at elevations between 8,000 and 8,500 feet. Those with low productivity are forested with potential forage production between 200 and 400 pounds per acre per year after canopy removal. Those with scattered forage contain 30-50 percent small meadows scattered within a forested area. These limitations can be overcome by special management practices or may make grazing less profitable than in units rated slight.

A severe limitation indicates that one or more properties are so unfavorable for livestock grazing that even with the most intensive range management the map unit is poorly suited for use as livestock range. ~~Units rated severe because of slope have dominant slopes greater than 45 percent~~. Those with short season are above 8,500 feet elevation. Those with low productivity are forested with potential forage production after canopy removal less than 200 pounds per acre per year. Those with scattered forage contain less than 30 percent small meadows scattered within a forested area.

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

TABLEB TAB7-1

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
12-1A	upper subalpine forest (70%)	245	70	35	350	35	108	162	115	385	124
	lower subalpine forest (20%)	210	105	35	350	25	216	323	231	770	162
12-1C	lower subalpine forest	210	105	35	350	25	216	323	231	770	162
12-2A	lower subalpine forest (75%)	210	105	35	350	25	302	453	323	1078	226
	upper subalpine forest (20%)	245	70	35	350	35	151	226	162	539	175
12-2B	upper subalpine forest (70%)	245	70	35	350	35	151	226	162	539	175
	lower subalpine forest (20%)	210	105	35	350	25	302	453	323	1078	226
13-1A	alpine turf and meadow	—	—	—	—	—	—	—	—	—	—
13-2A	alpine turf and meadow	—	—	—	—	—	—	—	—	—	—
22-1A	upper subalpine forest and lower subalpine forest	210	105	35	350	25	216	323	231	770	162
22-1B	open-grown forest (30%)	40	120	240	400	264	88	264	528	880	581
	mountain grassland (20%)	—	—	—	—	—	—	—	—	—	—
	lower subalpine forest (20%)	50	150	300	500	165	308	462	330	1100	257
22-1C	timberline forest (10-50%)	140	20	40	200	22	62	92	66	220	51
	alpine turf and meadow (0-50%)	—	—	—	—	—	—	—	—	—	—
22-2A	lower subalpine forest (50%)	210	105	35	350	25	237	356	254	847	178
	mountain meadow (15%)	—	—	—	—	—	—	—	—	—	—
22-3A	lower subalpine forest (50%)	210	105	35	350	25	302	453	323	1078	226
	dense Douglas-fir forest (15%)	140	175	35	350	35	431	323	323	1078	226
22-3C	lower subalpine forest (65-85%)	210	105	35	350	25	216	323	231	770	162
	upper subalpine forest (5-20%)	245	70	35	350	35	108	162	115	385	124

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
25-1A	alpine turf and meadow(45-70%)	—	—	—	—	—	—	—	—	—	—
	timberline forest (10-20%)	140	20	40	200	22	62	92	66	220	51
25-3A	alpine turf and meadow (45%)	—	—	—	—	—	—	—	—	—	—
	timberline forest (30%)	140	20	40	200	22	86	129	92	308	72
34-1A	upper subalpine forest	245	70	35	350	35	108	162	115	385	124
34-1B	mountain shrubland (75%)	—	—	—	—	—	—	—	—	—	—
	open-grown forest (20%)	40	120	240	400	264	88	264	528	880	581
34-1C	lower subalpine forest	210	105	35	350	25	216	323	231	770	162
34-1D	dense Douglas-fir forest (55%)	140	175	35	350	35	308	231	231	770	162
	open-grown forest (25%)	40	120	240	400	264	88	264	528	880	581
34-2C	upper subalpine forest (60%)	245	70	35	350	35	119	178	127	424	137
	mountain meadow (35%)	—	—	—	—	—	—	—	—	—	—
34-2D	lower subalpine forest (65%)	210	105	35	350	25	237	356	254	847	178
	mountain meadow (35%)	—	—	—	—	—	—	—	—	—	—
34-3A	upper subalpine forest	245	70	35	350	35	151	226	162	539	175
34-3B	lower subalpine forest	210	105	35	350	25	302	453	323	1078	226
34-4B	lower subalpine forest	210	105	35	350	25	302	453	323	1078	226
34-4C	mountain shrubland (75%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (25%)	140	175	35	350	35	339	254	254	847	178

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
35-1A	upper subalpine forest	245	70	35	350	35	108	162	115	385	124
35-1B	mountain shrubland	—	—	—	—	—	—	—	—	—	—
35-1C	lower subalpine forest	210	105	35	350	25	216	323	231	770	162
35-2C	lower subalpine forest (70%)	210	105	35	350	25	237	356	254	847	178
	mountain meadow (20%)	—	—	—	—	—	—	—	—	—	—
35-3A	upper subalpine forest (70%)	245	70	35	350	35	151	226	162	359	175
	mountain meadow (15%)	—	—	—	—	—	—	—	—	—	—
35-3B	lower subalpine forest	210	105	35	350	25	302	453	323	1078	226
35-4C	mountain shrubland (70%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (20%)	140	175	35	350	35	339	254	254	847	178
46-1B	mountain shrubland (75%)	—	—	—	—	—	—	—	—	—	—
	mountain grassland (15%)	—	—	—	—	—	—	—	—	—	—
46-2A	mountain grassland (45%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (35%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (20%)	140	175	35	350	35	339	254	254	847	178
46-3A	dense lodgepole pine forest	140	35	175	350	144	77	231	462	770	416
53-1A	mountain grassland (35%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (25%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (15%)	140	175	35	350	35	308	231	231	770	162

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
53-1D	lower subalpine forest (65%)	300	100	100	500	50	308	462	330	1100	224
		480	240	80	800	90	704	528	528	1760	539
53-3A	mountain shrubland (40%)	—	—	—	—	—	—	—	—	—	—
	mountain grassland (35%)	—	—	—	—	—	—	—	—	—	—
53-3B	lower subalpine forest (50%)	210	105	35	350	25	302	453	323	1078	226
	dense Douglas-fir forest (45%)	140	175	35	350	35	339	254	254	847	178
53-3C	lower subalpine forest	300	100	100	500	50	431	647	462	1540	314
54-1A	mountain grassland (35%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (35%)	—	—	—	—	—	—	—	—	—	—
54-1B	lower subalpine forest and dense Douglas-fir forest	40	120	240	400	264	88	264	528	880	581
54-1C	N dense Douglas-fir forest (45%)	140	175	35	350	35	308	231	231	770	162
	S open-grown forest (30%)	40	120	240	400	264	88	264	528	880	581
54-1E	upper subalpine forest	245	70	35	350	35	108	162	115	385	124
54-1G	N lower subalpine forest (60%)	210	105	35	350	25	216	323	231	770	162
	S dense Douglas-fir forest (15%)	140	175	35	350	35	308	231	231	770	162
54-2B	dense Douglas-fir forest (25%)	140	175	35	350	35	216	162	162	539	113
	mountain grassland (25%)	—	—	—	—	—	—	—	—	—	—
54-2C	lower subalpine forest	240	120	40	400	35	172	259	185	616	144

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
54-2D	mountain grassland (50%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (35%)	140	175	35	350	35	339	254	254	847	178
54-2E	lower subalpine forest	210	105	35	350	25	237	356	254	847	178
54-3A	mountain grassland (40%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (35%)	—	—	—	—	—	—	—	—	—	—
54-3C	dense Douglas-fir forest (50%)	140	175	35	350	35	339	254	254	847	178
	mountain grassland (25%)	—	—	—	—	—	—	—	—	—	—
54-3D	lower subalpine forest (55%)	300	100	100	500	50	431	647	462	1540	314
	dense Douglas-fir forest (20%)	190	30	80	300	35	259	388	277	924	207
54-3E	upper subalpine forest (65%)	245	70	35	350	35	151	226	162	539	175
	lower subalpine forest (25%)	210	105	35	350	25	302	453	323	1078	226
54-3F	lower subalpine forest (30%)	50	150	300	500	165	154	462	924	1540	554
	upper subalpine forest (15%)	245	70	35	350	35	151	226	162	539	175
54-5A	N dense Douglas-fir forest (35%)	350	115	35	500	20	440	330	330	1100	142
	S open-grown forest (30%)	40	120	240	400	265	246	370	264	880	338
54-5C	N dense Douglas-fir forest (50%)	350	115	35	500	20	446	330	330	1100	142
	S open-grown forest (15%)	40	120	240	400	265	246	370	264	880	338
61-2A	mountain grassland (30%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (30%)	—	—	—	—	—	—	—	—	—	—
	open-grown forest (30%)	40	120	240	400	264	44	132	264	440	290

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
64-2A	mountain grassland (30%)	—	—	—	—	—	—	—	—	—	—
	mountain grassland (30%)	—	—	—	—	—	—	—	—	—	—
	open-grown forest (35%)	40	120	240	400	264	44	132	264	440	290
64-2C	lower subalpine forest	700	560	140	1400	150	862	1294	924	3080	878
66-1A	riparian hardwoods	—	—	—	—	—	—	—	—	—	—
71-1A	lower subalpine forest (75%)	240	120	40	400	32	271	407	290	968	226
	mountain meadow (15%)	—	—	—	—	—	—	—	—	—	—
71-1B	mountain grassland (30%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (30%)	—	—	—	—	—	—	—	—	—	—
	lower subalpine forest (20%)	240	120	40	400	32	271	407	290	968	226
71-1C	upper subalpine forest (85%)	245	70	35	350	35	119	178	127	424	137
	mountain meadow (15%)	—	—	—	—	—	—	—	—	—	—
71-1D	lower subalpine forest	210	105	35	350	25	237	356	254	847	193
71-1E	dense Douglas-fir forest (55%)	140	175	35	350	35	339	254	254	847	152
	lower subalpine forest (30%)	240	120	40	400	32	271	407	290	968	226
	mountain grassland (15%)	—	—	—	—	—	—	—	—	—	—
71-2A	lower subalpine forest	300	100	100	500	50	431	647	462	1540	314
71-2B	lower subalpine forest (85%)	210	105	35	350	25	302	453	323	1078	226
	mountain meadow (15%)	—	—	—	—	—	—	—	—	—	—

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
71-2C	upper subalpine forest (55%)	245	70	35	350	35	151	226	162	539	175
	lower subalpine forest (30%)	240	120	40	400	35	345	517	370	1232	288
	mountain meadow (15%)	210	105	35	350	35	302	453	323	1078	226
71-2D	mountain shrubland (40%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (30%)	140	175	35	350	35	432	323	323	1078	226
	mountain grassland (20%)	—	—	—	—	—	—	—	—	—	—
82-2B	lower subalpine forest	210	105	35	350	25	237	356	254	847	178
82-2C	upper subalpine forest (70%)	245	70	35	350	35	119	178	127	424	137
	lower subalpine forest (15%)	210	105	35	350	35	237	356	254	847	178
84-1A	dense Douglas-fir forest (50%)	350	115	35	500	20	484	363	363	1210	156
	lower subalpine forest (30%)	240	120	40	400	32	271	407	290	968	226
	mountain meadow (20%)	—	—	—	—	—	—	—	—	—	—
84-1B	mountain grassland (50%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (30%)	—	—	—	—	—	—	—	—	—	—
84-2B	lower subalpine forest (55%)	240	120	40	400	32	246	370	264	880	206
	mountain grassland (20%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (15%)	140	175	35	350	35	308	231	231	770	178
85-2A	S open-grown forest (40%)	40	120	240	400	252	62	185	370	616	407
	N dense Douglas-fir forest (25%)	140	175	35	350	35	216	162	162	539	113
85-2B	N lower subalpine forest (45%)	240	120	40	400	32	172	259	185	616	144
	S dense Douglas-fir forest (30%)	140	175	35	350	35	216	162	162	539	113

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage.			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
85-3A	dense Douglas-fir forest (40%)	140	175	35	350	35	308	231	231	770	162
	mountain grassland (15%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (15%)	—	—	—	—	—	—	—	—	—	—
85-3B	lower subalpine forest (60%)	240	120	40	400	32	246	370	264	880	206
	dense Douglas-fir forest (20%)	140	175	35	350	35	308	231	231	770	162
86-2A	lower subalpine forest (45%)	240	120	40	400	32	271	407	290	968	226
	mountain meadow (30%)	—	—	—	—	—	—	—	—	—	—
86-2C	mountain grassland (45%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (40%)	—	—	—	—	—	—	—	—	—	—
86-2D	lower subalpine forest (60%)	210	105	35	350	25	237	356	254	847	178
	upper subalpine forest (15%)	245	70	35	350	35	119	178	127	424	137
86-2E	mountain meadow (50%)	—	—	—	—	—	—	—	—	—	—
	upper subalpine forest (45%)	245	70	35	350	35	119	178	127	424	137
86-3B	lower subalpine forest (60%)	210	105	35	400	25	216	323	231	770	162
	dense Douglas-fir forest (20%)	140	175	35	350	35	308	231	231	770	162
86-3C	mountain shrubland (55%)	—	—	—	—	—	—	—	—	—	—
	mountain grassland (30%)	—	—	—	—	—	—	—	—	—	—
87-1A	timberline forest (20-40%)	140	20	40	200	22	43	65	46	154	36
	alpine turf and meadow(10-20%)	—	—	—	—	—	—	—	—	—	—
87-1B	mountain grassland (50%)	—	—	—	—	—	—	—	—	—	—
	mountain shrubland (25%)	—	—	—	—	—	—	—	—	—	—
87-1D	lower subalpine forest	240	120	40	400	32	172	259	185	616	144

TABLE 7: POTENTIAL FOREST UNDERSTORY PRODUCTIVITY FOR LIVESTOCK FORAGE (lbs/Ac/Yr)

Map Unit Symbol	VEGETATIVE GROUP	UNDER FOREST CANOPY					AFTER FOREST CANOPY IS REMOVED				
		Herbage			Total	Total Livestock Forage	Herbage			Total	Total Livestock Forage
		Shrubs	Forbs	Grass			Shrubs	Forbs	Grass		
87-2A	S open-grown forest (50%)	40	120	240	400	252	97	290	581	968	639
	S mountain grassland (25%)	—	—	—	—	—	—	—	—	—	—
	N dense Douglas-fir forest (15%)	140	175	35	350	35	339	254	254	847	178
87-2B	N dense Douglas-fir forest (45%)	140	175	35	350	35	339	254	254	847	178
	N lower subalpine forest(25%)	210	105	35	350	25	237	356	254	847	178
	S open-grown forest (15%)	40	120	240	400	252	97	290	581	968	639
87-2C	mountain grassland (40%)	—	—	—	—	—	—	—	—	—	—
	dense Douglas-fir forest (25%)	140	175	35	350	35	339	254	254	847	178
	mountain shrubland (20%)	—	—	—	—	—	—	—	—	—	—
87-2D	lower subalpine forest	240	120	40	400	32	271	407	290	968	226
87-2E	upper subalpine forest (40%)	140	20	40	200	20	68	102	73	242	56
	mountain meadow (20%)	—	—	—	—	—	—	—	—	—	—
	lower subalpine forest (20%)	210	105	35	350	25	237	356	254	847	178
88-1A	lower subalpine forest	210	105	35	350	25	280	420	300	1001	210
88-2A	lower subalpine forest	210	105	35	350	25	280	420	300	1001	210
91-2B	lower subalpine forest (55%)	240	120	40	400	32	271	407	290	968	226
	mountain meadow (20%)	—	—	—	—	—	—	—	—	—	—
	upper subalpine forest (20%)	140	20	40	200	20	68	102	73	242	56
93-1A	alpine turf and meadow (5-30%)	—	—	—	—	—	—	—	—	—	—
	timberline forest (5-30%)	140	20	40	200	20	68	102	73	242	56

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
12-1A	upper subalpine forest (70%)	———	—	—	—	———	———	124	severe: low productivit
	lower subalpine forest (20%)							162	severe: low productivit
12-1C	lower subalpine forest	———	—	—	—	———	———	162	severe: low productivit
12-2A	lower subalpine forest (75%)	———	—	—	—	———	———	226	moderate: low productiv
	upper subalpine forest (20%)							175	severe: low productivit
12-2B	upper subalpine forest (70%)	———	—	—	—	———	———	175	severe: low productivit
	lower subalpine forest (20%)							226	moderate: low productiv
13-1A	alpine turfs and meadow	shallow	615	615	0	1230 ± 30	615	—	severe: short season
13-2A	alpine turfs and meadow	shallow	682	682	0	1365 ± 15	682	—	severe: short season
22-1A	lower subalpine forest and upper subalpine forest	———	—	—	—	———	———	162	severe: low productivit steep slopes
22-1B	open-grown forest (30%)	———	—	—	—	———	———	581	~~severe~~ moderate: steep slopes
	mountain grassland (20%)	thin breaks	302	445	145	892 ± 206	357	—	~~severe:~~ steep slopes
	lower subalpine forest (30%)	———	—	—	—	———	———	257	~~severe~~: steep slopes

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						Livestock Grazing Limitations
			Rangelands					Forest Sites	
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
22-1C	timberline forest (10-50%)	———	—	—	—	———	———	51	severe: steep slopes;
	alpine turfs and meadow (0-50%)	shallow	360	360	0	720 ± 70	412	—	short season
22-2A	lower subalpine forest (50%)							178	moderate: ~~severe:~~ steep slopes
	mountain meadow (15%)	silty	935	1290	0	2225 ± 105	1112	—	
22-3A	lower subalpine forest (50%)								severe: steep slopes
	dense Douglas-fir forest (15%)								severe: steep slopes
22-3C	lower subalpine forest (65-85%)	———	—	—	—	———	———	162	severe: low productivi
	upper subalpine forest (5-20%)	———	—	—	—	———	———	124	severe: low productivi
25-1A	alpine turfs and meadow (45-70%)	shallow	615	615	0	1230 ± 30	615	—	
	timberline forest (10-20%)	———	—	—	—	———	———	51	severe: short season
25-3A	alpine turfs and meadow (45%)	shallow	682	682	0	1365 ± 35	720	—	
	timberline forest (30%)	———	—	—	—	———	———	72	severe: short season
34-1A	upper subalpine forest	———	—	—	—	———	———	124	severe: low productivit
34-1B	mountain shrubland (75%)	stony	478	704	226	1408 ± 310	788	—	
	open-grown forest (20%)	———	—	—	—	———	———	581	slight
34-1C	lower subaline forest	———	—	—	—	———	———	162	severe: low productivi

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
34-1D	dense Douglas-fir forest (55%)	———	—	—	—	———	———	162	moderate: low productivity
	open grown forest (25%)	———	—	—	—	———	———	581	slight
34-2C	upper subalpine forest (60%)	———	—	—	—	———	———	137	moderate: scattered forage
	mountain meadow (35%)	clayey	935	1290	0	2225 ± 105	1112	—	moderate: short season
34-2D	lower subalpine forest (65%)	———	—	—	—	———	———	178	moderate: scattered forage
	mountain meadow (35%)	clayey	935	1290	0	2225 ± 105	1112	—	slight
34-3A	upper subalpine forest	———	—	—	—	———	———	175	severe: low productivity
34-3B	lower subalpine forest	———	—	—	—	———	———	226	moderate: low productivity
34-4B	lower subalpine forest	———	—	—	—	———	———	226	moderate: low productivity
34-4C	mountain shrubland (75%)	silty	618	910	292	1820 ± 103	728	—	slight
	dense Douglas-fir forest (25%)	———	—	—	—	———	———	178	moderate: low productivity
35-1A	upper subalpine forest	———	—	—	—	———	———	124	severe: low productivity; steep slopes
35-1B	mountain shrubland	shallow to gravel	400	200	200	800 ± 100	440	—	moderate: ~~severe:~~ steep slopes
35-1C	lower subalpine forest	———	—	—	—	———	———	162	severe: low productivity; steep slopes
35-2C	lower subalpine forest (70%)	———	—	—	—	———	———	178	severe: steep slopes
	mountain meadow (20%)	clayey	935	1290	0	2225 ± 104	1112	—	moderate: steep slopes

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						Livestock Grazing Limitations
			Rangelands					Forest Sites	
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
35-3A	upper subalpine forest (70%)	———	—	—	—	———	———	175	severe: steep slopes; low productivity
	mountain meadow (15%)	thin hilly	682	682	0	1365 ± 15	682	—	moderate: low productivity
35-3B	lower subalpine forest	———	—	—	—	———	———	226	severe: steep slopes
35-4C	mountain shrubland (70%)	silty	618	910	292	1820 ± 103	728	—	moderate: steep slopes
	dense Douglas-fir forest (20%)	———	—	—	—	———	———	178	severe: steep slopes
46-1B	mountain shrubland (75%)	silty; shallow to gravel	400	200	200	800 ± 100	440	—	slight
	mountain grassland (15%)	shallow to gravel	498	748	0	1245 ± 280	622	—	slight
46-2A	mountain grassland (45%)	shallow to gravel	498	748	0	1245 ± 280	622	—	slight
	mountain shrubland (35%)	silty; shallow to gravel	478	704	226	1408 ± 309	563	—	slight
	dense Douglas-fir forest (20%)	———	—	—	—	———	———	178	moderate
46-3A	dense lodgepole pine forest	———	—	—	—	———	———	416	slight
53-1A	mountain grassland (35%)	thin breaks	498	748	0	1245 ± 280	622	—	slight
	mountain shrubland (25%)	thin breaks	478	704	226	1408 ± 309	563	—	slight
	dense Douglas-fir forest (15%)	———	—	—	—	———	———	162	moderate: low productivity

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
53-1D	lower subalpine forest	———	—	—	—	———	———	224	moderate: low productivity
53-3A	mountain shrubland (40%)	silty	794	1170	374	2338 ± 412	935	—	slight
	mountain grassland (35%)	silty	654	980	0	1634 ± 108	817	—	slight
53-3B	lower subalpine forest (50%)	———	—	—	—	———	———	226	moderate: low productivity
	dense Douglas-fir forest (45%)	———	—	—	—	———	———	178	moderate: low productivity
53-3C	lower subalpine forest	———	—	—	—	———	———	314	moderate: low productivity
54-1A	mountain grassland (35%)	thin breaks	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
	mountain shrubland (35%)	thin breaks	478	704	226	1408 ± 309	563	—	moderate: ~~severe:~~ steep slopes
54-1B	lower subalpine forest and dense Douglas-fir forest	———	—	—	—	———	———	581	severe: steep slopes
54-1C	dense Douglas-fir forest(45%)-N	———	—	—	—	———	———	162	severe: steep slopes
	open-grown forest (30%)-S	———	—	—	—	———	———	581	severe: steep slopes
54-1E	upper subalpine forest	———	—	—	—	———	———	124	severe: steep slopes; low productivity
54-1G	lower subalpine forest (60%)-N	———	—	—	—	———	———	162	severe: steep slopes; low productivity
	dense Douglas-fir forest(15%)-S	———	—	—	—	———	———	162	severe: low productivity

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						Livestock Grazing Limitations
			Rangelands					Forest Sites	
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
54-2B	dense Douglas-fir forest (25%)	———	—	—	—	———	———	113	severe: steep slopes
	mountain grassland (25%)	thin breaks	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
54-2C	lower subalpine forest	———	—	—	—	———	———	144	severe: steep slopes; low productivity
54-2D	mountain grassland (50%)	thin hilly	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
	dense Douglas-fir forest (35%)	———	—	—	—	———	———	178	severe: steep slopes; low productivity
54-2E	lower subalpine forest	———	—	—	—	———	———	178	severe: steep slopes; low productivity
54-3A	mountain grassland (40%)	silty	654	980	0	1634 ± 108	817	—	moderate: ~~severe:~~ steep slopes
	mountain shrubland (35%)	silty	749	1170	374	2338 ± 412	935	—	moderate: ~~severe:~~ steep slopes
54-3C	dense Douglas-fir forest (50%)	———	—	—	—	———	———	178	severe: steep slopes; low productivity
	mountain grassland (20%)	thin breaks	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
54-3D	lower subalpine forest (55%)	———	—	—	—	———	———	314	severe: steep slopes
	dense Douglas-fir forest (20%)	———	—	—	—	———	———	207	severe: steep slopes
54-3E	upper subalpine forest (65%)	———	—	—	—	———	———	175	severe: steep slopes; low productivity
	lower subalpine forest (25%)	———	—	—	—	———	———	226	severe: steep slopes

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						Livestock Grazing Limitations
			Rangelands					Forest Sites	
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
54-3F	lower subalpine forest (30%)	———	—	—	—	———	———	554	severe: steep slopes
	upper subalpine forest (15%)	———	—	—	—	———	———	175	severe: steep slopes; low productivity
54-5A	dense Douglas-fir forest(35%)-N	———	—	—	—	———	———	142	severe: steep slopes
	open-grown forest (30%)-S	———	—	—	—	———	———	338	severe: steep slopes
54-5C	dense Douglas-fir forest(50%)-N	———	—	—	—	———	———	142	severe: steep slopes; low productivity
	open-grown forest (15%)-S	———	—	—	—	———	———	338	severe: steep slopes
61-2A	mountain grassland (30%)	limy; silty	654	980	0	1634 ± 670	817	—	slight
	mountain shrubland (30%)	silty	618	910	292	1820 ± 103	728	—	slight
	open-grown forest (30%)	———	—	—	—	———	———	290	moderate: low productivity
64-2A	mountain grassland (30%)	limy; silty	654	980	0	1634 ± 670	817	—	slight
	mountain shrubland (30%)	silty	618	910	292	1820 ± 103	728	—	slight
	open-grown forest (30%)	———	—	—	—	———	———	290	moderate: low productivity
64-2C	lower subalpine forest	———	—	—	—	———	———	878	slight
66-1A	riparian hardwoods	wet land	2552	638	210	3400 ± 505	2380	—	slight

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						Livestock Grazing Limitations
			Rangelands					Forest Sites	
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
71-1A	lower subalpine forest (75%)	———	—	—	—	———	———	226	severe: scattered forage
	mountain meadow (15%)	subirrigated	1155	1595	0	2750 ± 400	1375	—	slight
71-1B	mountain grassland (30%)	clayey	654	980	0	1634 ± 108	817	—	slight
	mountain shrubland (30%)	subirrigated	794	1170	374	2338 ± 413	935	—	slight
	lower subalpine forest (20%)	———	—	—	—	———	———	226	moderate: low productivity
71-1C	upper subalpine forest (85%)	———	—	—	—	———	———	137	severe: scattered forage
	mountain meadow (15%)	subirrigated	1155	1595	0	2150 ± 400	1375	—	moderate: short season
71-1D	lower subalpine forest	———	—	—	—	———	———	193	severe: scattered forage
71-1E	dense Douglas-fir forest (45%)	———	—	—	—	———	———	152	severe: low productivity
	lower subalpine forest (30%)	———	—	—	—	———	———	226	moderate: low productivity
	mountain grassland (15%)	clayey	654	980	0	1634 ± 103	817	—	severe: scattered forage
71-2A	lower subalpine forest	———	—	—	—	———	———	314	moderate: low productivity
71-2B	lower subalpine forest (85%)	———	—	—	—	———	———	226	moderate: low productivity
	mountain meadow (15%)	subirrigated	1115	1595	0	2750 ± 419	1375	—	severe: scattered forage
71-2C	upper subalpine forest (55%)	———	—	—	—	———	———	175	severe: low productivity
	lower subalpine forest (30%)	———	—	—	—	———	———	226	moderate: low productivity
	mountain meadow (15%)	subirrigated	115	1595	0	2750 ± 419	1375	—	severe: scattered forage
71-2D	mountain shrubland (40%)	silty	618	910	292	1820 ± 104	728	—	slight
	Douglas-fir forest (25%)	———	—	—	—	———	———	226	moderate: low productivity
	mountain grassland (20%)	silty	654	980	0	1634 ± 108	817	—	slight

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
82-2B	lower subalpine forest	———	—	—	—	———	———	178	severe: low productivity
82-2C	upper subalpine forest (70%)	———	—	—	—	———	———	137	severe: low productivity
	lower subalpine forest (15%)	———	—	—	—	———	———	178	severe: low productivity
84-1A	dense Douglas-fir forest (50%)	———	—	—	—	———	———	156	severe: low productivity
	lower subalpine forest (30%)	———	—	—	—	———	———	226	moderate: low productivity
	mountain meadow (10%)	clayey	935	1290	0	2225 ± 105	1112	—	severe: scattered forage
84-1B	mountain grassland (50%)	silty	654	980	0	1634 ± 108	817	—	slight
	mountain shrubland (30%)	silty	618	910	292	1820 ± 108	728	—	slight
84-2B	lower subalpine forest (60%)	———	—	—	—	———	———	206	moderate: low productivity
	mountain grassland (20%)	silty	654	980	0	1634 ± 108	817	—	severe: scattered forage
	dense Douglas-fir forest (15%)	———	—	—	—	———	———	178	severe: low productivity
85-2A	open-grown forest (40%)-S	———	—	—	—	———	———	407	slight
	dense Douglas-fir forest(25%)-N	———	—	—	—	———	———	113	severe: steep slopes
85-2B	lower subalpine forest (45%)-N	———	—	—	—	———	———	114	severe: steep slopes
	dense Douglas-fir forest(30%)-S	———	—	—	—	———	———	113	severe: steep slopes
85-3A	dense Douglas-fir forest (40%)	———	—	—	—	———	———	162	severe: steep slopes
	mountain grassland (15%)	thin breaks	498	748	0	1245 ± 280	622	—	~~severe:~~ moderate: steep slopes
	mountain shrubland (15%)	thin breaks	478	704	226	1408 ± 309	563	—	~~severe:~~ moderate: steep slopes

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
85-3B	lower subalpine forest (60%)	———	—	—	—	———	———	206	severe: steep slopes
	dense Douglas-fir forest (20%)	———	—	—	—	———	———	162	severe: steep slopes; low productivity
86-2A	lower subalpine forest (45%)	———	—	—	—	———	———	226	moderately: low productivi
	mountain meadow (30%)	silty	935	1290	0	2225 ± 104	1112	—	moderate: scattered forage
86-2C	mountain grassland (45%)	clayey	654	980	0	1634 ± 108	817	—	slight
	mountain shrubland (40%)	silty	618	910	292	1820 ± 108	728	—	slight
86-2D	lower subalpine forest (60%)	———	—	—	—	———	———	178	severe: low productivity
	upper subalpine forest (15%)	———	—	—	—	———	———	137	severe: low productivity
86-2E	mountain meadow (45%)	subirrigated	935	1290	0	2225 ± 104	none	—	moderate: short season
	upper subalpine forest (35%)	———	—	—	—	———	———	137	severe: low productivity
86-3B	lower subalpine forest (60%)	———	—	—	—	———	———	162	severe: low productivity
	dense Douglas-fir forest (20%)	———	—	—	—	———	———	162	severe: low productivity
86-3C	mountain shrubland (55%)	silty	618	910	292	1820 ± 108	728	—	slight
	mountain grassland (30%)	silty	654	980	0	1634 ± 108	817	—	slight
87-1A	timberline forest (20-40%)	———	—	—	—	———	———	36	severe: steep slopes; short season
	alpine turfs and meadow (10-20%)	shallow	652	652	0	1305 ± 45	652	—	severe: short season
87-1B	mountain grassland (50%)	thin hilly	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
	mountain shrubland (25%)	thin hilly	478	704	226	1408 ± 309	563	—	moderate ~~severe:~~ steep slopes

TABLE 8: RANGE MANAGEMENT

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
87-1D	lower subalpine forest	———	—	—	—	———	———	144	severe: steep slopes low productivity
87-2A	open-grown forest (50%)-S	———	—	—	—	———	———	639	severe: steep slopes
	mountain grassland (25%)-S	thin hilly	498	748	0	1245 ± 280	622	—	moderate: ~~severe:~~ steep slopes
	dense Douglas-fir forest(15%)-N	———	—	—	—	———	———	178	severe: low productivity
87-2B	dense Douglas-fir forest(45%)-N	———	—	—	—	———	———	178	severe: low productivity
	lower subalpine forest (25%)-N	———	—	—	—	———	———	178	severe: steep slopes
	open-grown forest (15%)-S	———	—	—	—	———	———	639	severe: steep slopes
87-2C	mountain grassland (40%)	silty	654	980	0	1634 ± 108	817	—	severe: steep slopes
	dense Douglas-fir forest (25%)	———	—	—	—	———	———	178	severe: steep slopes
	mountain shrubland (20%)	silty	618	910	292	1820 ± 108	728	—	moderate: ~~severe:~~ steep slopes
87-2D	lower subalpine forest	———	—	—	—	———	———	226	severe: steep slopes
87-2E	upper subalpine forest (40%)	———	—	—	—	———	———	56	severe: steep slopes
	mountain meadow (20%)	silty	935	1290	0	2225 ± 105	1112	—	moderate ~~severe:~~ steep slopes
	lower subalpine forest (20%)	———	—	—	—	———	———	178	severe: steep slopes
88-1A	lower subalpine forest	———	—	—	—	———	———	210	moderate: low productivity
88-2A	lower subalpine forest	———	—	—	—	———	———	210	moderate: low productivity

Unit Symbol	Vegetative Group	Range Site Soil Group	Potential Productivity (lbs/ac/yr)						
			Rangelands					Forest Sites	Livestock Grazing Limitations
			Grass	Forbs	Shrubs	Herbage	Forage	Transitory Forage	
91-2B	lower subalpine forest (55%)	———	—	—	—	———	———	226	moderate: low productivit
	mountain meadow (20%)	silty	935	1290	0	2225 ± 105	1112	—	moderate: scattered forag
	upper subalpine forest (20%)	———	—	—	—	———	———	56	severe: low productivity
93-1A	alpine turfs and meadow (5-30%)	shallow	652	652	0	1305 ± 45	652	—	severe: short season; scattered forage
	timberline forest (5-30%)	———	—	—	—	———	———	56	severe: scattered forage

POTENTIAL WILDLIFE HABITAT

The survey area contains diverse and abundant wildlife. Over 300 different species are present. This diversity results from the broad range of habitats available. The survey area has a wide variety of vegetative types in a variety of successional stages.

Seven species of big game, four species of upland game birds, a variety of waterfowl, numerous nongame birds, and many small mammals live in the area. The most popular game animal is the elk. About 9,800 elk winter in or adjacent to the survey area. Summer range in the survey area is estimated to be capable of supporting about 32,000 elk. Since winter range is much less abundant, it is limiting to population. Winter range within the survey area and adjacent to it is estimated to carry 12,600 elk at maximum.

Of the 9,800 elk presently wintering in the survey area, most are native or resident within the survey area. There are three migratory herds of elk that summer in Yellowstone National Prak, but winter in or near the survey area--generally from 2,500 to 5,000 animals. Hunter harvest in 1980 was about 1,200. This is representative of normal conditions.

Mule deer are in most areas. The Bridger Mountains, the Crazy Mountains, and foothills of the Gallatin and Absaroka-Beartooth support large herds. Harvest in 1980 was about 2,600. Whitetail deer also live on the fringes of the survey area, but are not common, and winter outside the survey area. Harvest for 1980 was 96.

Moose are widely distributed in the survey area, especially in the Gallatin and Absaroka-Beartooth Ranges. Harvest for 1980 was 110.

Bighorn sheep in the survey area are all descendants of native bands and are in all mountain ranges except the Crazies and Bridgers. The Crazies and Bridgers are potential transplant sites. Harvest for 1980 was 21.

Mountain goats were successfully transplanted to the Crazy, Absaroka, and Madison Ranges between 1941 and 1958. In 1969, they were introduced to the Bridger Range. Presently, they occupy areas in common with bighorn sheep. There were 23 harvested in 1980.

Black bears are not abundant, but they are the most common large predator. Harvest was 159 in 1980. Mountain lions are uncommon but have been seen in areas having high deer populations. The grizzly bear, a threatened species, presently occupies the more remote parts of the survey area and areas adjacent to Yellowstone Park. Occasional wolf or wolverine sightings indicate these rare predators use some areas. There are also many kinds of smaller mammals. These include badgers, coyotes, mink, raccoons, beavers, weasels, mice, voles and squirrels.

The bald eagle, an endangered species, winters along major waterways in the survey area. Presently there are two reproductive pairs nesting within the survey area. Golden eagles are relatively common and can be seen nearly everywhere. Osprey are most common near Hebgen Lake and on the Madison River near Yellowstone. Prairie and peregrine falcons nest in some remote locations. Trumpeter swans and sandhill cranes have been sighted on Hebgen Lake. Hebgen Lake provides good waterfowl habitat. At present probably very little breeding activity occurs here, but the large lake and its shallow water areas provide valuable resting, concentration and feeding areas for migrants in the fall. Edwards Peninsula on the lake has been fenced to exclude grazing and to provide waterfowl nesting cover. It also provides feeding areas in the shallow protected bays, and cover for waterfowl hunters.

Local bird watching groups use the survey area to see species not commonly sighted on prairie or private lands. Of interest are the various woodpeckers, mountain chickadee, dipper, grouse, great gray and saw-whet owl, jays, ravens, finches, warblers, juncos, grosbeaks, goshawk, and Cooper's and sharpshinned hawks.

The Franklin, blue and ruffed grouse are significant game birds. Sage grouse are occasionally seen. Blue grouse inhabit the grassland-forest edges and Douglas-fir forests. Ruffed grouse find adequate habitat in the moist, deciduous vegetation along small streams with adjacent coniferous forest. Both species occur in all areas, but the Bridger and Crazy Mountains have the highest populations of blue grouse. Sharptailed grouse utilize grasslands and juniper-limber pine cover in the open foothills of the north and the east parts of the survey area. Potential turkey habitat and transplant sites exist on private and National Forest lands in the eastern foothills of the Crazy and Bridger Mountains, and in the Deer Creeks. Poor hunter access has limited most upland gamebird harvest in these areas.

Three major rivers that cross the Forest--the Gallatin, Madison and Yellowstone--are classified as "Blue Ribbon" streams of national significance. Coldwater fish species found within the survey area include cutthroat, rainbow, brown, golden, and brook trout, rainbow-cutthroat trout hybrids, arctic grayling, and mountain whitefish. The Yellowstone cutthroat, upper Missouri cutthroat, and Arctic grayling are classified by the State of Montana as "Species of Special Concern." Also, numerous tributary and headwater streams support populations of smaller cutthroat, rainbow, or brook trout.

The Forest contains about 1,000 miles of fishing streams and 18,800 acres of lakes which contain about 1,500,000 catchable trout. Total stream trout population is about 500,000. The Forest's lakes are inhabited by an estimated 1,000,000 catchable fish.

Wildlife habitat management generally involves the coordination of timber harvest, grazing, recreation, and other uses with the use of habitat by wildlife. Habitat may also be improved directly by practices such as prescribed burning, water developments, or fencing to exclude livestock.

Soil properties, elevation, aspect, and slope directly affect the kind and amount of vegetation available to wildlife for food and cover. If a map unit has potential for wildlife habitat, it may currently be suitable habitat or habitat can be created by manipulating the vegetation.

Tables 9 and 10 POTENTIAL WIDLIFE HABITAT rate the potential of map units to provide habitat for the principal game species and grizzly bear. All of the rated species occupy large ranges and have diverse habitat requirements within their range. Individual map units can supply only part of the necessary habitat. Therefore, the ratings should be used with other information on species' range and requirements.

The ratings can be used in planning to compare the potential wildlife habitat values of alternative areas and to identify areas with potential for habitat improvement. The ratings can also be used to map potential area suitability and seasonal use for rated species. These ratings should not be used for project design or specific habitat evaluations without onsite investigation.

The potential of map units to provide forage and cover for each species is rated. The season of year when the forage is normally available is also given. Forage class is rated "good," "fair," and "poor." A rating of "good" indicates that the map unit has potential to produce a diversity of highly desirable forage species. A rating of "fair" indicates that the potential production is composed of a few highly desirable forage species but is mostly forage of inter mediate value. A rating of "poor" indicates that the potential production is mostly low value forage species.

Forage availability is the time of year when the forage is available to the wildlife species. Availability is determined by winter temperatures, depth of snow pack, slope, elevation, and aspect.

Forage availability is separated into three seasons: summer, fall, and winter. Summer includes the period from June 15 to September 15. Fall includes the period from September 15 until November 15. Winter includes the period from November 15 until June 15.

The cover class is rated "good," "fair," and "poor." A rating of "good" indicates that vegetation or topography provides ample security, screening, and escape cover. A rating of "fair" indicates limited vegetation or topography for wildlife security, screening, or escape cover. A rating of "poor" indicates a lack of vegetation or topography necessary for wildlife security, screening, or escape cover.

The ratings are based on map unit characteristics and the following species habitat requirements:

Mule deer normally summer in Douglas-fir forests. Their diet is composed of approximately 80 percent browse. They browse on low shrubs such as snowberry, service berry, ninebark, and sagebrush. Mule deer normally winter on lower elevation foothills. Winter range normally contains sagebrush and bunch grasses on south facing slopes, and Douglas-fir forests on northern exposures (Kufeld, et al., 1973).

Elk normally summer at mid-elevations. Their summer range normally contains moist mountain meadows within moist forest types. Their summer diet is mostly herbaceous plants. Elk winter on lower elevations foothills. Winter range noramlly contains bunchgrass and low shrubs on south facing slopes and Douglas-fir forests on north facing slopes (Hammond, 1980) (Forest Service, 1982).

Bighorn sheep and mountain goats summer on high elevation mountain peaks and ridges. Their summer diet is almost exclusively herbaceous plants. Winter range can be on high elevation windswept ridges or lower elevation ridges. Bighorn sheep winter diet is generally grasses and forbs. Mountain goat winter diet is almost exclusively conifer needles (Pallister, G. L., 1974) (Peck, 1972) (Constan, 1967).

Moose summer in moist mountain meadows and adjacent moist forest types. Their summer diet consists of about one-third herbaceous plants and two-thirds browse from willow and conifer seeedlings. Moose winter ranges typically are willow bottoms or old growth timber stands with abundant subalpine fir seedlings and saplings in the understory. Generally, winter range is below 7,000 feet where snow depths are less than 30 inches. Their winter diet consists almost entirely of browse from willow or conifer saplings and seedlings (Schladweiler, 1974).

Grizzly bear summer range frequently overlaps elk summer range. Their summer diet is mostly succulent, herbaceous plants found in moist mountain meadows and adjoining moist forest types. In fall, they tend to favor pine nuts, roots and some mammals (Interagency Study Team, 1981) (Mealey, 1977).

TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

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M.U. NO.	MULE DEER FORAGE CLASS	MULE DEER FORAGE AVAILABILITY	MULE DEER COVER CLASS	ELK FORAGE CLASS	ELK FORAGE AVAILABILITY	ELK COVER CLASS	BIGHORN SHEEP FORAGE CLASS	BIGHORN SHEEP FORAGE AVAILABILITY	BIGHORN SHEEP COVER CLASS	BLUE GROUSE FORAGE CLASS	BLUE GROUSE FORAGE AVAILABILITY	BLUE GROUSE COVER CLASS
12-1A	poor	summer, fall	good	fair	fall	good	fair	summer, fall	good	good	fall, winter	
12-1C	poor	summer	good	fair	summer, fall	good	poor	fall	good	poor	fall	
12-2A	poor	summer, fall	good	fair	summer, fall	good	poor	fall	good	poor	fall	
12-2B	poor	summer, fall	good	fair	summer, fall	good	fair	summer, fall	good	good	fall, winter	
13-1A	fair	summer	poor	fair	summer	poor	good	all seasons (winter, ridge-tops only)	poor	poor	fall	
13-2A	fair	summer	poor	fair	summer	poor	good	all seasons (winter, ridge-tops only)	poor	poor	fall	
22-1A	poor	summer, fall	good	poor	summer, fall	good	fair	summer, fall	good	fair	fall	
22-1B	fair	all seasons	fair	fair	fall, winter	fair	good	fall, winter	fair	good	spring, summer	
22-1C	poor	summer	good	poor	summer, fall	poor	good	summer, fall	good	poor	fall	
22-2A	poor	summer, fall	good	fair	summer, fall	good	fair	summer, fall	good	fair	fall	
22-3A	poor	summer, fall	good	fair	summer, fall	good	fair	summer, fall	good	fair	fall	
22-3C	poor	summer, fall	good	fair	summer, fall	good	fair	summer, fall	good	fair	summer, fall	
25-1A	fair	summer	fair	good	summer, fall	fair	good	summer	poor	fair	fall, winter	
25-3A	fair	summer	fair	good	summer, fall	fair	good	summer	poor	fair	fall, winter	
34-1A	fair	summer	good	good	summer, fall	good	fair	fall	good	fair	fall, winter	

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TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER			ELK			BIGHORN SHEEP			BLUE GROUSE		
	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS
34-1B	good	all seasons[1/]	poor	fair	fall, winter[1/]	poor	fair	fall, winter[1/]	poor	fair	summer	
34-1C	poor	summer, fall	good	fair	summer, fall	good	poor	summer	good	poor	fall	
34-1D	good	summer, fall	good	good	fall	fair	fair	winter	fair	good	summer	
34-2C	fair	summer, fall	good	good	summer, fall	good	poor	fall	fair	good	fall, winter	
34-2D	fair	summer, fall	good	good	summer, fall	good	poor	fall	fair	fair	fall	
34-3A	fair	summer	good	good	summer, fall	good	fair	fall	good	fair	fall, winter	
34-3B	poor	summer	good	good	summer, fall	good	poor	fall	good	poor	fall	
34-4B	fair	summer, fall	good	fair	summer, fall	good	poor	fall	fair	fair	fall	
34-4C	good	all seasons[1/]	poor	good	fall, winter[1/]	poor	poor	winter	poor	fair	summer	
35-1A	fair	summer	good	fair	summer, fall	good	fair	summer, fall	good	fair	fall	
35-1B	good	all seasons	poor	good	fall, winter	poor	good	winter	poor	good	spring	
35-1C	poor	summer, fall	good	fair	summer, fall	good	fair	fall	good	poor	fall	
35-2C	fair	summer, fall	good	good	summer, fall	good	fair	fall	good	poor	fall	
35-3A	fair	summer	good	good	summer, fall	good	fair	fall	fair	fair	fall, winter	
35-3B	poor	summer	good	good	summer, fall	good	poor	fall	good	poor	fall	
35-4C	good	all seasons[1/]	poor	good	fall, winter[1/]	poor	poor	winter	poor	fair	summer	
46-1B	good	winter	poor	good	winter	poor	fair	winter	poor	good	spring	

TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER			ELK			BIGHORN SHEEP			BLUE GROUSE		
	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS
46-2A	good	winter	poor	good	winter	poor	fair	winter	poor	good	spring	
46-3A	fair	summer	fair	fair	fall	fair	poor	fall	poor	poor	fall	
53-1A	good	summer, fall, winter	poor	good	fall, winter	poor	fair	fall, winter	fair	good	spring	
53-1D	poor	summer, fall	good	fair	summer, fall	good	poor	fall	good	poor	fall	
53-3A	good	fall, winter	poor	good	fall, winter	poor	fair	fall, winter	poor	good	spring, summer	
53-3B	good	summer, fall	good	good	fall	good	poor	fall	good	good	fall	
53-3C	fair	summer, fall	good	good	summer, fall	good	poor	fall	good	poor	fall	
54-1A	good	summer, fall, winter	fair	good	fall, winter	fair	good	winter	fair	good	spring, summer, fall	
54-1B	fair	summer, fall	good	good	fall	good	good	fall, winter[1/]	good	good	summer, fall	
54-1C	good	summer, fall	good	fair	fall	good	fair	winter[1/]	good	fair	summer, fall	
54-1E	fair	summer, fall	good	fair	fall	good	good	fall	good	good	fall, winter	
54-1G	good	summer, fall	good	fair	fall	good	fair	fall	good	fair	summer, fall	
54-2B	fair	summer, fall, winter	fair	fair	fall, winter	fair	fair	winter[1/]	fair	good	spring, summer	
54-2C	fair	summer, fall	good	fair	summer, fall	good	poor	fall	good	fair	fall	

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TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER			ELK			BIGHORN SHEEP			BLUE GROUSE		
	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS
54-2D	good	fall, winter	poor	fair to good	winter	poor	fair	winter	poor	good	spring	
54-2E	fair	summer, fall	good	fair	fall	good	poor	fall	good	fair	fall	
54-3A	good	fall, winter	poor	good	fall, winter	poor	good	winter	poor	good	spring, summer	
54-3C	good	fall, winter	fair	fair	fall, winter	fair	fair	winter	fair	good	spring, summer	
54-3D	poor	summer, fall	good	good	summer, fall	good	fair	fall	good	fair	fall	
54-3E	poor	summer, fall	good	fair	summer, fall	good	good	fall	good	good	fall, winter	
54-3F	fair	summer, fall	good	good	fall	good	good	fall	good	good	fall	
54-5A	good	all seasons	good	good	fall, winter	fair	fair	fall, winter	good	good	spring, summer	
54-5C	good	summer, fall	good	fair	fall	good	poor	fall	good	fair	fall	
61-2A	fair	fall	poor	fair	fall	poor	poor	fall	poor	fair	summer	
64-2A	fair	all seaons	poor	fair	winter	poor	fair	winter	poor	fair	summer, fall	
64-2C	poor	summer	good	good	summer, fall	good	poor	fall	good	poor	fall	
66-1A	poor	summer	fair	good	summer	poor	good	poor	poor	poor	fall	
71-1A	poor	summer	good	good	summer	good	poor	summer	good	fair	fall	
71-1B	good	fall, winter[1/]	poor	good	fall, winter[1/]	poor	fair	winter	poor	fair	spring, summer	
71-1C	poor	summer, fall	good	good	summer, fall	good	fair	fall	good	good	fall, winter	

TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER FORAGE CLASS	MULE DEER FORAGE AVAILABILITY	MULE DEER COVER CLASS	ELK FORAGE CLASS	ELK FORAGE AVAILABILITY	ELK COVER CLASS	BIGHORN SHEEP FORAGE CLASS	BIGHORN SHEEP FORAGE AVAILABILITY	BIGHORN SHEEP COVER CLASS	BLUE GROUSE FORAGE CLASS	BLUE GROUSE FORAGE AVAILABILITY	BLUE GROUSE COVER CLASS
71-1D	fair	summer, fall	good	good	summer, fall	good	poor	fall	good	good	fall	
71-1E	good	summer, fall	fair	good	fall	fair	fair	fall	poor	good	summer, fall	
71-2A	poor	summer	good	good	summer, fall	good	poor	summer, fall	good	fair	fall	
71-2B	fair	summer	good	fair	summer	good	poor	fall	good	fair	fall	
71-2C	poor	summer	good	good	summer	good	fair	fall	good	good	fall, winter	
71-2D	good	fall, winter[1/]	poor	good	fall, winter[1/]	poor	fair	fall, winter[1/]	fair	good	spring, summer	
82-2B	fair	summer	good	good	fall	good	poor	summer, fall	good	fair	summer	
82-2C	fair	summer	good	good	summer	good	fair	summer	good	good	fall, winter	
84-1A	fair	summer, fall	good	good	summer, fall	good	fair	fall[1/]	good	fair	summer	
84-1B	good	fall, winter	fair	good	fall, winter	poor	fair	fall, winter	poor	good	spring, summer	
84-2B	good	summer, fall	good	fair	fall	good	fair	fall[1/]	good	good	summer, fall	
85-2A	good	summer, fall, winter	good	fair	fall	good	fair	winter	good	good	summer, fall	
85-2B	good	summer	good	fair	summer	good	poor	summer, fall	good	good	summer, fall	
85-3A	good	summer, fall, winter	good	fair	fall	—	fair	winter	good	good	summer, fall	
85-3B	good	summer, fall	good	fair	summer, fall	—	fair	fall	good	good	summer, fall	

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TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER			ELK			BIGHORN SHEEP			BLUE GROUSE		
	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS
86-2A	fair	summer	fair	good	summer, fall	fair	poor	summer, fall	fair	fair	fall	
86-2C	good	summer, fall[1/]	poor	good	fall, winter[1/]	poor	poor	fall, winter	poor	fair	summer, fall	
86-2D	fair	summer	good	good	summer, fall	good	poor	fall	good	poor	fall	
86-2E	fair	summer	good	good	summer, fall	good	fair	summer, fall	good	good	fall, winter	
86-3B	fair	summer, fall	good	fair	fall	good	poor	fall	good	good	fall	
86-3C	good	summer, fall	poor	fair	fall	poor	poor	fall	poor	fair	summer, fall	
87-1A	fair	summer, fall	good	good	summer, fall	good	good	summer, fall, winter	good	fair	fall	
87-1B	fair	summer, fall, winter	poor	fair	fall, winter	poor	fair	fall, winter	poor	fair	summer, fall	
87-1D	fair	summer	good	poor	summer	good	poor	summer, fall	good	fair	fall	
87-2A	good	summer, fall	good	good	fall	fair	fair	fall	fair	good	summer	
87-2B	fair	summer	good	good	fall	good	fair	fall	fair	good	summer, fall	
87-2C	good	summer, fall[1/]	fair	fair	fall, winter[1/]	fair	fair	fall, winter[1/]	poor	fair	summer	
87-2D	fair	summer	good	good	summer	good	poor	fall	good	poor	fall	
87-2E	fair	summer	good	good	summer, fall	good	good	summer, fall	good	good	fall, winter	
88-1A	poor	summer	good	poor	summer	good	poor	fall	good	poor	fall	

TABLE 9: POTENTIAL FOR WILDLIFE HABITAT FOR MULE DEER, ELK, ROCKY MOUNTAIN BIG HORN SHEEP, AND BLUE GROUSE

M.U. NO.	MULE DEER			ELK			BIGHORN SHEEP			BLUE GROUSE		
	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS	FORAGE CLASS	FORAGE AVAILABILITY	COVER CLASS
88-2A	poor	summer	good	fair	summer, fall	good	poor	fall	good	poor	fall	
91-2B	poor	summer	fair	fair	summer, fall	fair	good	summer, fall	fair	fair	fall	
93-1A	poor	summer	poor	poor	summer	poor	good	summer	poor	poor	fall	

1/ Delineations occupy variable landscape positions. Forage is available during late fall and winter on only some of them.

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TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF-NESTING~~ RAPTORS

M.U. NO.	MOUNTAIN GOAT [4] FORAGE CLASS	MOUNTAIN GOAT FORAGE AVAILABILITY	MOUNTAIN GOAT COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
12-1A	fair	fall	good	fair	fall, winter [2]	good	good	fall	good
12-1C	poor	fall	good	good	fall, winter [2]	good	poor	summer, fall	good
12-2A	poor	fall	good	good	fall, winter [2]	good	poor	summer, fall	good
12-2B	fair	fall	good	fair	fall, winter [2]	good	good	fall	good
13-1A	good	summer, fall	poor	poor	summer	poor	fair	summer	poor
13-2A	good	summer, fall	poor	poor	summer	poor	fair	summer	poor
22-1A	fair	summer, fall	good	fair	summer, fall	poor	fair	fall	good
22-1B	good	winter	fair	fair	fall, winter	fair	fair	spring	fair
22-1C	good	all seaons (winter-ridges only)	good	poor	summer	poor	poor	fall	poor
22-2A	poor	fall, winter	good	fair	summer, fall	good	fair	summer	good
22-3A	fair	all seasons (winter-ridges only)	good	fair	summer, fall	good	fair	fall	good
22-3C	poor	summer	good	good	summer, fall	good	good	summer, fall	good
25-1A	good	summer, fall	poor	fair	summer, fall	fair	good	summer, fall	fair
25-3A	good	summer, fall	poor	fair	summer, fall	fair	good	summer, fall	fair
34-1A	fair	fall	good	fair	summer, fall, winter [2]	good	good	fall	good

TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT 4/ FORAGE CLASS	MOUNTAIN GOAT FORAGE AVAILABILITY	MOUNTAIN GOAT COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
34-1B	poor	winter 1/	poor	poor	fall 1/	poor	good	spring	poor
34-1C	poor	fall	good	good	summer, 2/ fall, winter 2/	good	fair	summer	good
34-1D	fair	winter	fair	poor	winter	fair	poor	spring	fair
34-2C	poor	fall	fair	good	summer, 2/ fall, winter 2/	good	good	summer, fall	good
34-2D	poor	fall	fair	good	summer, fall, winter 2/	good	good	summer	good
34-3A	poor	fall	fair	good	summer, 2/ fall, winter 2/	good	good	good fall	good
34-3B	poor	fall	good	good	summer, 2/ fall, winter 2/	good	fair	summer	good
34-4B	poor	fall	fair	fair	summer, 2/ fall, winter 2/	good	fair	summer	good
34-4C	poor	winter	poor	poor	fall	poor	fair	spring	poor
35-1A	fair	fall	good	fair	summer, fall	good	good	fall	good
35-1B	fair	winter	poor	poor	fall	poor	good	spring	poor
35-1C	poor	fall	fair	fair	summer, fall	good	poor	summer	good
35-2C	poor	fall	fair	good	summer, 2/ fall, winter 2/	good	good	summer	good
35-3A	fair	fall	fair	good	summer, fall	good	good	fall	good

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TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT [4] FORAGE CLASS	MOUNTAIN GOAT [4] FORAGE AVAILABILITY	MOUNTAIN GOAT [4] COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
35-3B	poor	fall	fair	good	summer, [2] fall, winter [2]	good	fair	summer	good
35-4C	poor	winter	poor	poor	fall	poor	fair	spring	poor
46-1B	—	—	—	poor	fall	poor	fair	spring	poor
46-2A	—	—	—	fair	fall, winter [3]	poor	good	spring	poor
46-3A	—	—	—	fair	summer, fall	fair	poor	summer, fall	fair
53-1A	—	—	—	poor	fall	poor	fair	spring	poor
53-1D	—	—	—	good	summer, [2] fall, winter [2]	good	poor	summer	good
53-3A	—	—	—	poor	fall	poor	good	spring	poor
53-3B	—	—	—	fair	fall	good	fair	summer	good
53-3C	—	—	—	good	fall, winter [2]	good	fair	summer	good
54-1A	fair	winter	fair	poor	fall	poor	fair	spring	fair
54-1B	good	fall, winter	good	poor	fall	good	poor	summer	fair
54-1C	fair	winter	good	fair	fall	good	poor	summer	good
54-1E	good	fall	good	poor	fall	good	fair	fall	good

TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT [4] FORAGE CLASS	MOUNTAIN GOAT [4] FORAGE AVAILABILITY	MOUNTAIN GOAT [4] COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
54-1G	fair	fall	good	fair	fall	good	poor	fall	good
54-2B	fair	winter	good	poor	fall	fair	poor	summer	fair
54-2C	fair	fall	good	fair	summer, fall	good	poor	summer	good
54-2D	fair	winter	poor	poor	winter	poor	fair	spring	poor
54-2E	fair	fall	good	poor	fall	good	fair	fall	good
54-3A	poor	fall	poor	poor	fall	poor	good	spring	poor
54-3C	poor	fall	poor	poor	fall	fair	fair	spring	poor
54-3D	poor	fall	good	good	summer, fall	good	fair	summer	good
54-3E	good	fall	good	fair	fall	good	good	fall	good
54-3F	fair	fall, winter	good	fair	fall	good	fair	summer	good
54-5A	—	—	—	poor	fall	fair	fair	spring	poor
54-5C	—	—	—	fair	fall	good	fair	summer	good
61-2A	—	—	—	faor	fall [3]	poor	fair	spring	poor
64-2A	—	—	—	good	fall, winter [3]	poor	fair	spring, summer [3]	good
64-2C	—	—	—	good	summer, fall, winter [2]	good	good	summer	good

TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT [4] FORAGE CLASS	MOUNTAIN GOAT [4] FORAGE AVAILABILITY	MOUNTAIN GOAT [4] COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
66-1A	—	—	—	good	summer, fall, winter	fair	good	summer	fair
71-1A	—	—	—	good	summer, fall, winter [2]	good	good	summer, fall	good
71-1B	—	—	—	poor	fall	poor	fair	spring	poor
71-1C	poor	fall	good	good	summer, fall, winter [2]	good	good	summer, fall	good
71-1D	—	—	—	fair	summer, fall, winter [2]	good	fair	summer, fall	good
71-1E	—	—	—	fair	fall, winter	fair	fair	summer	fair
71-2A	—	—	—	good	summer, fall, winter [2]	good	good	summer	good
71-2B	—	—	—	good	summer, fall, winter [2]	good	gppd	summer	good
71-2C	fair	fall	good	good	summer, fall	good	good	summer, fall	good
71.2D	—	—	—	poor	fall	poor	fair	spring	poor
82-2B	—	—	—	good	fall, winter [2]	good	fair	summer	good
82-2C	fair	fall	good	good	summer, fall	good	good	summer, fall	good
84-1A	poor	fall	good	good	summer, fall, winter [2]	good	good	summer, fall	good

TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT 4/ FORAGE CLASS	MOUNTAIN GOAT FORAGE AVAILABILITY	MOUNTAIN GOAT COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
84-1B	—	—	—	poor	fall	poor	fair	spring	poor
84-2B	—	—	—	good	fall, winter	fair	poor	summer	good
85-2A	fair	fall, winter	good	poor	fall	good	poor	summer	good
85-2B	fair	fall	good	fair	summer, fall	good	poor	summer	good
85-3A	—	—	—	poor	fall	good	fair	spring	fair
85-3B	—	—	—	fair	fall	good	fair	summer	good
86-2A	—	—	—	good	summer, fall	good	good	summer	good
86-2C	—	—	—	fair	fall, winter 3/	poor	good	spring	poor
86-2D	—	—	—	good	summer, fall, winter 2/	good	good	summer	good
86-2E	fair	summer, fall	fair	good	summer, fall	good	good	summer, fall	good
86-3B	—	—	—	fair	summer, fall, winter 2/	good	poor	summer	good
86-3C	—	—	—	poor	fall	poor	poor	summer	poor
87-1A	fair	summer, fall, winter	fair	fair	summer	fair	good	summer, fall	good
87-1B	poor	fall, winter	poor	poor	fall	poor	fair	spring	good
87-1D	poor	fall	good	fair	fall	good	poor	summer	good

TABLE 10: POTENTIAL WILDLIFE HABITAT FOR MOUNTAIN GOAT, MOOSE, GRIZZLY BEAR, ~~AND CLIFF NESTING RAPTORS~~

M.U. NO.	MOUNTAIN GOAT 4/ FORAGE CLASS	MOUNTAIN GOAT 4/ FORAGE AVAILABILITY	MOUNTAIN GOAT 4/ COVER CLASS	MOOSE FORAGE CLASS	MOOSE FORAGE AVAILABILITY	MOOSE COVER CLASS	GRIZZLY BEAR FORAGE CLASS	GRIZZLY BEAR FORAGE AVAILABILITY	GRIZZLY BEAR COVER CLASS
87-2A	—	—	—	fair	fall	fair	fair	spring	fair
87-2B	poor	fall	good	good	summer, fall, winter 2/	good	fair	summer	good
87-2C	—	—	—	poor	fall	poor	fair	spring	poor
87-2D	poor	fall	good	good	summer, fall	good	good	summer	good
87-2E	fair	summer, fall	fair	good	summer, fall	good	good	summer, fall	fair
88-1A	—	—	—	poor	fall	good	poor	summer	good
88-2A	—	—	—	poor	fall	good	poor to fair	summer	good
91-2B	fair	summer, fall	fair	fair	summer, fall	fair	fair	summer, fall	fair
93-1A	good	summer, fall	poor	poor	summer	poor	poor	summer	poor

1/ Delineations occupy variable landscape positions. Forage is available during late fall and winter on only some of them.

2/ M.U. is used in winter only if vegetation is old growth forest with numerous subalpine fir seedlings in understory.

3/ Forage restricted to stream-side zones, seeps, and springs.

4/ For mountain goats, some map units are outside of the normal range for the species. Therefore, forage potential, availability, and cover quality are unknown.

WILDFIRE MANAGEMENT

Plans for wildfire control are incorporated into land management plans and fire management plans. Planning wildfire control requires estimation of suppression costs and predicting the effects of fire on resources.

Table 10 gives information that fire management officers and others can use to predict fire behavior, suppression costs, and the soil erosion and landslide hazard associated with suppression activities.

Fire groups are based on the response of the tree species to fire and the roles those tree species take during successional stages (Fischer and Clayton, 1983). They are groups of habitat types with similar fire behavior characteristics. These are generalized to only the most dominant groups.

Average fuel loadings are the average amount of downed, dead woody fuels. These consist of dead twigs, branches, stems, and boles of trees and shrubs that have fallen and lie on or near the ground (Brown and Sec. 1981). They are derived from the fire groups in column 2.

Fire intensity level for forested sites are predicted using the average fuel loadings (Deeming, et al, 1978). Fire intensity levels for grasslands are from Brown, 1982.

A "very low" fire intensity level indicates that fires can be attacked with hand tools. Flame lengths are from 0-2 feet. Fire fighters can work right up to the fire.

A "low" level indicates the fire can be attacked by hand tools. Flame lengths are from 2.1 to 3.9 feet. This rating includes the upper limit of manual attack directly on the fire line. A "moderate" level means direct attack with hand tools is impractical. Use of equipment e.g. tankers, dozers, retardant, etc, is effective. Handline will not reliably hold the fire. Fires are potentially dangerous to people and equipment. Flame lengths range from 4-6 feet. "High" fire intensity indicates the fire may present serious control problems. There may be torching, crowning, or spotting. Heat load on people is dangerous within 30 feet. Direct attack is not effective or feasible.

Mountain shrublands containing big sagebrush were rated "moderate" to "high." Mountain grasslands were rated "low" to "moderate." The ratings of fuel loadings and fire intensity are averages. They may be used for planning but are too variable to use at specific sites without onsite investigation.

Selection of suppression method is partially dependent on the terrain and soils. Steep slopes are a "severe" limitation to machinery, but only a "moderate" limitation to hand line. Factors such as heavy turf, stones in the soil, and dense brush affect the ease of hand line construction. Machinery use can be limited by slope steepness, rock outcrop, wet areas, and landslide hazards.

The degree and kind of limitations for hand and machine constructed fire line are given under limitations to fire line construction. A "slight" limitation indicates that properties are favorable for construction. A "moderate" limitation indicates that construction is feasible, but difficult and slow. A "severe" limitation indicates the construction method is impractical, dangerous, or too slow.

When soil erosion is listed as a limitation to machine construction, seeding and drainage of fire lines and temporary roads should be considered for erosion control.

When landslides are listed as a limitation to machine construction, the occurrence of landslides may be increased. If landslides are detrimental to land management objectives, the use of hand constructed lines across unstable slopes should be considered.

RECREATION

The survey area has the highest recreation use in Montana. Its proximity to Yellowstone National Park attracts a large number of visitors. There are 37 campgrounds, 14 picnic areas, 2 developed ski areas (Big Sky and Bridger Bowl), and a visitor center at Earthquake Lake. There are a number of snowmobile trails, crosscountry ski trails, and trailheads.

Use of developed recreation facilities was 591,000 R.V.D.s (Recreation Visitor Days) in 1980. Dispersed recreation totaled 1,340,000 R.V.D. from such activities as automobile travel, hiking, fishing, camping, and hunting. About 15 percent or 201,000 R.V.D. of the dispersed recreation was in two wilderness areas adjacent to the survey area.

MINERALS

The survey area has some known areas with significant minerals potential and some areas of interest for oil, gas, and geothermal exploration.

Of all minerals activities presently taking place in the survey area, exploratory and pilot operations in the Boulder River area for platinum and chromium, and near Jardine for gold, are by far the most significant.

Other minerals activities or potentials include some travertine mining in the Gardiner area, coal deposits in several locations that were mined in the past extensive and proven phosphate deposits in the Hebgen Lake area, as well as oil, gas, and geothermal potential. At present, 199,000 acres of oil and gas leases have been granted and 130,000 more have been applied for. There has been extensive seismic exploration. There is a geothermal potential in the Corwin Springs area near Gardiner.

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
12-1A	cold, moist-site upper ABLA	2.0	17.8	very low	moderate: rocky soils	slight
12-1C	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: rocky soils	slight
12-2A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight
12-2B	cold, moist-site upper ABLA	2.0	17.8	very low	slight	slight
13-1A	alpine turf	—	—	very low	moderate: rocky surface	moderate: rock outcrop
13-2A	alpine turf	—	—	very low	moderate: rocky surface	slight
22-1A	dry-site lower ABLA or PICO; rock	2.9	17.9	very low	moderate: rocky soils	severe: steep slopes; soil erosion
22-1B	moist-site PSME; rock	2.7	6.9	very low-moderate	moderate: rocky soils	severe: steep slopes; soil erosion
22-1C	rock; cold, moist-site upper ABLA	2.0	17.8	very low	moderate: rocky soils	severe: steep slopes; soil erosion
22-2A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: rocky soils	severe: steep slopes; landslides

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
22-3A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: rocky soils	severe: steep slopes
22-3C	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: bouldery soils	severe: steep slopes
25-1A	alpine turf; cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas; soil erosion
25-3A	alpine turf; cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas
34-1A	cold, moist-site upper ABLA	2.0	17.8	very low	severe: bouldery soils	moderate bouldery surface
34-1B	grassland	—	—	low-high	moderate: rocky soils	slight
34-1C	moist-site lower ABLA	3.0	24.2	very low-moderate	moderate: rocky soils	moderate: wet areas
34-1D	dry-site PSME	1.6	5.7	very low	moderate: rocky soils	slight
34-2C	cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas landslides
34-2D	dry-site lower ABLA or PICO	2.9	17.9	very low	slight	slight

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
34-3A	cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas
34-3B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	moderate: wet areas
34-4B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight
34-4C	grassland	—	—	low-high	slight	slight
35-1A	cold, moist-site upper ABLA	2.0	17.8	very low	severe: bouldery surface	severe: steep slopes; soil erosion
35-1B	grassland	—	—	low-high	moderate: rocky soils	severe: steep slopes
35-1C	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: rocky soils	severe: steep slopes; soil erosion
35-2C	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	severe: steep slopes; landslides
35-3A	cold, moist-site upper ABLA	2.0	17.8	very low	moderate: rocky soils	severe: steep slopes
35-3B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	severe: steep slopes

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
35-4C	grassland	—	—	low-high	slight	severe: steep slopes
46-1B	grassland	—	—	low-high	slight	slight
46-2A	grassland	—	—	low-high	slight	slight
46-3A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight
53-1A	PIFL, PIPO and PSME bunch grass types	1.2	6.2	very low	moderate: rocky soils	slight
53-1D	moist-site lower ABLA	3.0	24.2	very low-moderate	severe: brush	moderate: wet areas
53-3A	grassland	—	—	low-high	slight	slight
53-3B	N aspect; moist-site lower ABLA	3.0	24.2	very low-moderate	slight	slight
	S aspect; moist-site PSME	2.7	6.9	very low-moderate	slight	moderate
53-3C	moist-site lower ABLA	3.0	24.2	very low-moderate	slight	slight
54-1A	grassland	—	—	low-high	moderate: rocky soils	severe: steep slopes
54-1B	dry-site lower ABLA or PICO; rock	2.9	17.9	very low-high	severe: rocky soils	severe: steep slopes; soil erosion

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand		Limitations to Fire Line Construction: With Heavy Equipment	
					Limitation		Limitation	
54-1C	moist-site PSME	2.7	6.9	very low-moderate	moderate:	rocky soils	severe:	steep slopes soil erosion
54-1E	cold, moist-site upper ABLA	2.0	17.8	very low	moderate:	rocky soils	severe:	steep slopes; soil erosion
54-1G	N aspect; dry-site lower ABLA or PICO;	2.9	17.9	very low-high	severe:	brush	severe:	steep slopes
	S aspect; moist-site PSME	2.7	6.9	very low-high				
54-2B	dry-site PSME; rock	1.6	5.7	very low	moderate:	rocky soils; heavy bunchgrass	severe:	rock outcrop; steep slopes
54-2C	dry-site lower ABLA or PICO; rock	2.9	17.9	very low-moderate	moderate:	rocky soils	severe:	rock outcrop; steep slopes
54-2D	grassland	—	—	low-high	moderate:	rocky soils	severe:	steep slopes; landslides
54-2E	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate:	rocky soils	severe:	steep slopes; landslides

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
54-3A	grassland	—	—	low-high	moderate: rocky soils	moderate: steep slopes
54-3C	dry-site PSME	1.6	5.7	very low	moderate: rocky soils	severe: steep slopes
54-3D	dry-site lower ABLA or PICO	2.9	17.9	very low-high	moderate: rocky soils	moderate: steep slopes
54-3E	cold, moist-site upper ABLA	2.0	17.8	very low	moderate: rocky soils	severe: steep slopes
54-3F	dry-site lower ABLA or PICO	2.9	17.9	very low-high	moderate: rocky soils	severe: steep slopes; rock outcrop
54-5A	N aspect; moist-site PSME;	2.7	6.9	very low-high	moderate: rocky soils	severe: steep slopes
	S aspect; dry site PSME	1.6	5.7	low-low		severe: rock outcrop
54-5C	N aspect; moist-site PSME;	2.7	6.9	very low-high	severe: brush	severe: steep slopes
	S aspect; dry-site PSME	1.6	5.7	very low		severe: rock outcrop

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
61-2A	grassland	—	—	low-high	slight	slight
64-2A	grassland	—	—	low-high	slight	slight
64-2C	moist-site lower ABLA	3.0	24.2	very low	slight	moderate: wet areas
66-1A	meadow; willows	—	—	very low	moderat: wet areas	severe: wet areas
71-1A	moist-site lower ABLA	3.0	24.2	very low	slight	severe: wet areas landslides
71-1B	grassland	—	—	low-high	slight	moderate: landslides
71-1C	cold, moist-site upper ABLA	2.0	17.8	very low	slight	severe: wet areas landslides
71-1D	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: heavy bunchgrass	slight
71-1E	moist-site PSME	2.7	6.9	very low-moderate	moderate: heavy bunchgrass	moderate: wet areas
71-2A	moist-site lower ABLA	3.0	24.2	very low	slight	severe: wet areas landslides
71-2B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
71-2C	cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas; landslides
71-2D	grassland	—	—	low-high	slight	slight
82-2B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	moderate: landslides
82-2C	cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas; landslides
84-1A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: brush	moderate: landslides
84-1B	PIFL, PIPO and PSME bunch grass types	1.2	6.2	very low	slight	moderate: landslides
84-2B	dry-site lower ABLA or PICO; grassland	2.9	17.9	very low-moderate	slight	slight
85-2A	moist-site PSME; grassland	2.7	6.9	very low	moderate: rocky soils	severe: steep slopes; rock outcrop

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
					Limitation	Limitation
85-2B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: rocky soils	moderate: steep slopes; landslides
85-3A	moist-site PSME	2.7	6.9	very low	slight	moderate: steep slopes
85-3B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	moderate: steep slopes
86-2A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight
86-2C	grassland	—	—	low-high	slight	slight
86-2D	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	moderate: wet areas landslides

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand — Limitation	Limitations to Fire Line Construction: With Heavy Equipment — Limitation
86-2E	meadow; cold, moist-site upper ABLA	2.0	17.8	very low	slight	moderate: wet areas; landslides
86-3B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	slight
86-3C	grassland	—	—	low-high	slight	slight
87-1A	rock; cold, moist-site upper ABLA; alpine turf	2.0	17.8	very low	moderate: steep slopes; rocky soils	severe: steep slopes; soil erosion
87-1B	grassland	—	—	low-high	moderate: steep slopes	severe: steep slopes
87-1D	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: steep slopes; rocky soils	severe: steep slopes; soil erosion
87-2A	dry-site PSME; grassland	1.6	5.7	very low	moderate: steep slopes	severe: steep slopes; landslides

TABLE 11: WILDFIRE MANAGEMENT

Map Unit Symbol	Fire Habitat Type Group	Average Fuel Loading (Tons/acre) Small (1/4"-3")	Average Fuel Loading (Tons/acre) Large (3+")	Fire Intensity Level	Limitations to Fire Line Construction: By Hand	Limitations to Fire Line Construction: With Heavy Equipment
87-2B	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: heavy bunchgrass; brush	severe: steep slopes; landslides
87-2C	grassland	—	—	low-high	slight	severe: steep slopes; landslides
87-2D	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	slight	severe: steep slopes; landslides
87-2E	cold, moist-site upper ABLA; meadow	2.0	17.8	very low	slight	severe: steep slopes; soil erosion
88-1A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: heavy bunchgrass	slight
88-2A	dry-site lower ABLA or PICO	2.9	17.9	very low-moderate	moderate: heavy bunchgrass	slight
91-2B	dry-site lower ABLA or PICO; meadow	2.9	17.9	very low-moderate	slight	slight
93-1A	talus	—	—	very low	severe: talus	severe: talus; soil erosion

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Section 6. Glossary of Terms

Alluvial - Pertaining to material or processes associated with transportation or deposition by running water.

Alluvial fan - A low, outspread body of alluvium, whose surface forms a segment of a cone that radiates downslope (like an open fan) from the point where a stream emerges from a narrow valley onto a plain.

Alluvial terrace - See stream terrace

Alpine turf - A class of vegetation consisting of low growing forbs and grasses associated with the harsh climatic conditions at high elevations.

Aquic soil moisture regime - A soil which is free of dissolved oxygen because it is saturated with water.

Arterial roads - Roads which provide service to large land areas and usually connect with public highways or other arterial roads to form an integrated network of primary travel routes.

Association - A map unit in which a mixture of two or more kinds of soil, or soil and other map unit component, occur together in some regularity of pattern such that the components could be mapped separately at the scale of mapping.

Avalanche chute - The flow pathway along which an avalanche moves, often forming a long, narrow channel on a steep mountain slope.

Avalanche debris - A mass of rock and soil which accumulates at the bottom of an avalanche chute.

Boulders - Rock fragments larger than 24 in. (60 cm) in diameter.

Braided stream - A stream that divides and follows an interlacing network of several small branching and reuniting shallow channels.

Clean sandstone - A relatively pure or well-washed sandstone containing little matrix; i.e., a sandstone with less than 10 percent clay matrix.

Clearcut - A silvicultural forest regeneration method where all trees on a site are removed at one time.

Cobble - Rock fragments from 3 in. (76 mm) to 10 in. (250 mm) in diameter.

Collector road - Collects traffic from local roads and/or terminal facilities; serves smaller areas than an arterial road, and is usually connected to an arterial road or a public highway.

Colluvium - Any loose, heterogeneous, incoherent mass of soil material or rock fragments deposited by gravitational forces, usually at the base of a steep slope or a cliff.

Complex - A map unit in which a mixture of two or more kinds of soil, or soil and other map unit component, occur together in a pattern so intricate they cannot be delineated separately at the scale of mapping.

Consociation - A map unit in which a single kind of soil, or defined map unit component, dominates the map unit. Three-fourths or more of the map unit fits within the soil taxon that provides the reference name for the map unit or can be defined to fit within soils that are interpretively similar for the purposes of the survey.

Cryic soil temperature regime - A soil which at 50 cm below the soil surface (unless the soil is shallower), has a mean annual soil temperature less than 8·C (47·F) and a mean summer (June, July, and August) temperature less than 8·C if an O horizon is present (15·C if an O horizon is not present).

Cuesta - An asymetric ridge with one face (dip slope) long and gentle, conforming with the dip of the underlying resistant beds and the opposite face (scarp slope) steep or even cliff like formed by outcrop of the resistant rocks.

Delineation - A single occurrence of a map unit encompassed by and within the outline of an area drawn on a map.

Dip Slope - A land slope roughly conforming to and controlled by the angle of inclination (dip) of the underlying rock.

Dissected slopes - A slope which exhibits deeply cut stream coarses (gullies and revines) at frequent enough intervals and with enough depth to create a significant change in management recommendations when compared to a similar slope without observable dissections.

Entrenched stream - A stream flowing in a narrow trench, or valley, cut into a sideslope or plain.

Fault scarp - A steep slope formed directly by movement along one side of a fault.

Floodplain - The land bordering a stream or river, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Flow plateau - A comparatively flat extensive area considerably elevated (more than 150 m; 500 ft.) above the adjacent country which is supported by an underlying extensive volcanic flow.

Frigid soil temperature regime - A soil which, at 50 cm below the soil surface (unless the soil is shallower), has a mean annual temperature of less than 8·C (47·F) and a summer mean temperature (months of June, July, and August) of greater than 8·C if the soil has an O horizon. The difference between mean winter (months of December, January, and February) and mean summer temperatures must be greater than 5·C (9·F). Summer mean temperatures exceed 15·C (59·F) if no O horizon is present.

Frostchurned - The churning or modification including any other disturbances of soil, resulting from frost action such as frost heaving and solifluction. Patterned ground may be produced.

Frost wedges - A term used loosely for any ice wedge, either active or fossil; any wedge shaped mass whose origin involves freezing conditions. In this survey area they consist of vertical wedge shaped inclusions in the soil mantle containing coarse, angular rock fragments and few fines. The genesis of these features is inferred.

Geomorphology - The science that treats the general configuration of the earth's surface, specifically the study of the classification, description, nature, origin and development of landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features.

Glacial cirque - Semicircular, concave, bowl-like areas with steep faces primarily resulting from past or present glacial ice and snow abrasion.

Glacial cirque headwall - Refers to the steep rock face above the cirque basin.

Glacial drift - Rock debris that has been transported by glaciers and deposited, either directly from the ice or from melt water. The debris may or may not be heterogeneous.

Glacial moraine - A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly glacial till.

Glacial outwash - Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice.

Glacial till - Unsorted, unstratified and generally unconsolidated material deposited directly by a glacier without subsequent reworking by water. It consists of a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape.

Glacial troughwalls - Steep sides of a U-shaped glacial valley. Typically refers to alpine glaciation.

Glacially scoured slopes - Slopes which have been abraded by glacial action leaving areas of exposed bedrock and thin deposits of till.

Gravel - Rock fragments from .008 in. (2 mm) to 3 in. (76 mm) in diameter.

Hogback - Any ridge with a sharp summit and steep slopes of nearly equal inclination. The term is usually restricted to ridges carved from beds dipping at angles greater than 20·.

Hummocky relief - A series of rounded or conical mounds causing an uneven, rolling appearance to the landscape.

Landslide - A mass-wasting process and the landform produced, involving moderately rapid to rapid (greater than 1 foot per year) downslope transport, by means of gravitational stresses, of a mass of rock and regolith.

Mapping criteria - The set of map unit characteristics, either differentiating or accessary, used as a basis for justifying separation of sets of delineations on maps into map units.

Map unit (mapping unit) - A described set of delineations on a map encompassing land areas of similar character.

Outsloped road - Graded toward the embankment to produce a downward slope across the road surface to the side of the road away from the cut slope.

Outwash plain - A broad, outspread, flat or gently sloping, alluvial sheet of outwash deposited by melt water streams flowing in front of or beyond the terminal morain of a glacier; the surface of a broad body of outwash.

Patterned ground - More or less symmetrical forms such as circles, polygons, nets, stripes, garlands and steps that are characteristic of, but not confined to mantles subjected to intense frost action as in periglacial environments. Stone polygons generally form on slopes of less than 8 percent, while garlands and stripes occur on slopes of 8 - 15 percent and more than 15 percent, respectively.

Pergelic soil temperature regime - A soil which, at 50 cm below the soil surface (unless the soil is shallower), has a mean annual soil temperature of less than 0·C (32·F).

Periglacial environment - Conditions occurring at the immediate margins of former and existing glaciers and ice sheets, and influenced by the cold temperature of the ice.

Phase criteria - (Soil map units) A characteristic of a map unit identified to serve a specific functional purpose in an individual soil survey which is not covered in definitions of soil taxonomic classes mapped in the survey.

Photo signature - (Mapping) An identifiable characteristic on a photograph which can be correlated with a mappable feature important to the mapper's purpose.

Random sample - A sample of a population taken without a procedure induced bias thus assuring the sample is as representative of the population sampled as possible.

Riparian - Bordering a lake or stream.

Relief - The elevations or differences in elevation of a land surface, considered collectively.

Rock glacier - A mass of poorly sorted angular boulders and fine material cemented by interstitial ice a meter or so below the surface. It has the general appearance and slow movement of a small valley glacier with a distal area (toe) marked by a series of transverse, arcuate, rounded ridges.

Rolling grade (road) - Short length gradient reversal from the normal road grade to collect water on the travel way surface and deliver it to the edge of the road.

Scarp slope - A relatively steep slope facing in a direction opposite to the dip of the strata.

Scree - A sheet of coarse (fragmented) debris mantling a slope (see Talus).

Selection - A silvicultural forest regeneration method where trees are removed periodically, individually or in small groups, from an uneven-aged forest in order to realize the yield and establish a new crop of uneven age distribution.

Shelterwood - A silvicultural forest regeneration method where part of the residual forest stand is left on a site to provide a source of seed for a new even aged stand.

Slope gradient classes -

nearly level	0 - 10 percent
gently sloping	10 - 20 percent
moderately steep	20 - 45 percent
steep	45 - 65 percent
very steep	>65 percent

Slope unravelling (dry ravelling) - Sloughing of soil, organic material and rock on steep slopes during dry periods.

Soil - The collection of natural bodies on the earth's surface, in places modified or even made by man, of earthy materials, containing living matter and supporting or capable of supporting plants out-of-doors.

Soil reaction - The degree of acidity or alkalinity of a soil, expressed as the logarithm of the hydrogen ion concentration (pH). A soil at pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The reaction classes are defined as:

	pH
extremely acid	below 4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
moderately acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
moderately alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	9.1 and higher

Stones - Rock fragments from 10 in. (25 cm) to 24 in. (60 cm) in diameter.

Stream channel gradient classes -

low	< 5 percent
moderate	5 to 10 percent
steep	> 10 percent

Stream dissection - The gully, revine, or canyon which has been cut into an otherwise relatively uniform land surface by a stream.

Stream, entrenched - A stream which flows in a narrow gully or ravine cut into a slope or plain.

Stream, intermittent - A stream, or reach of a stream, that flows for protracted periods only when it receives groundwater discharge or long-continued contributions from melting snow or other surface and shallow subsurface sources.

Stream pattern, dendritic - A stream pattern in which the streams branch irregularly in all directions and at almost any angle.

Stream pattern, deranged - A distinctively disordered stream pattern which shows a complete lack of underlying bedrock or structural control. It is characterized by irregular streams that flow into and out of lakes, by few short tributaries, and by swampy interstream areas.

Stream pattern, parallel - A stream pattern in which the streams and their tributaries are regularly spaced and virtually parallel to one another.

Stream pattern, trellis - A stream pattern characterized by parallel main streams intersected at or near right angles by their tributaries which, in turn, are fed by elongated secondary tributaries parallel to the main streams.

Stream, perennial - A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Stream, poorly defined - A stream with a poorly developed stream bed and banks hard to define if running water is absent. They are often in dips or swales and the channel may contain some gravel but only at its lowest point or center. Riparian vegetation is uncommon but may occur as clumps in low points of microrelief close to the stream.

Stream terrace - One of a series of platforms in a stream valley, flanking and more or less parallel to the stream, and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former stage of erosion or deposition.

Stream, well defined - A stream with a well developed stream bed and a tendency to have near vertical banks along low gradient areas. Banks are often occupied by riparian vegetation and the channel is well established, commonly with a gravel bottom.

Structurally controlled slopes - The arrangement, disposition and erosional characteristics of underlying rocks determine, to a significant degree, terrain shape. Faulting and uplift of bedrock (especially limestone, shale, and sandstone) and subsequent erosion create a repeating pattern on the landscape, with weaker strata forming low areas and more erosion resistant strata forming ridges and outcrops.

Talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope.

Taxonomic unit - A class in the soil taxonomic (classification) system used to define soils in a soil survey. A taxonomic unit may be defined at any categorical level in the soil classification system being used.

Udic soil moisture regime - A soil which, in the moisture control section of the soil profile, is not dry (<-15 bar soil water potential) for as long as 90 days in most years and is not dry for 45 consecutive days in the 4 months following summer solstace, 6 or more years out of 10.

Ustic soil moisture regime - A soil which, in the moisture control section of the soil profile, is dry (<-15 bar soil water potential) for 90 or more days in most years but is not dry more than half the time the soil temperature is above 5°C at 50 cm depth. This moisture regime is intended to recognize soils which are dry most of the time but moisture is present when conditions are suitable for plant growth.

Undifferentiated group - A map unit in which two or more soils, considered dissimilar for the purpose of the survey, are combined because some mapping criteria related to the survey's interpretive purpose is considered to override soil definition. Soil occurrence is not required to have a regular pattern within each delineation.

Water bar - A ridge made across a road surface to divert water.

Welded tuff - A pyroclastic rock that has been indurated by the combined action of the heat retained by particles, the weight of overlying material, and hot gasses.